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A  
DESCRIPTIVE CATALOGUE  
OF THE  
INDIAN DEEP-SEA CRUSTACEA  
DECAPODA MACRURA AND ANOMALA,  
IN THE  
INDIAN MUSEUM.

BEING A REVISED ACCOUNT OF THE DEEP-SEA SPECIES

COLLECTED BY THE

ROYAL INDIAN MARINE SURVEY SHIP  
INVESTIGATOR.

BY

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#### PREFACE.

In *An Account of the Deep-Sea Brachyura collected by the Royal Indian Marine Survey Ship Investigator* published by the Trustees of the Indian Museum in 1899, and in the *Scientific Memoirs by Medical Officers of the Army of India* for the same year, I have explained something of how, and under what limitations, the "Investigator" collections have been made.

In the present memoir the Decapod Crustacea of the suborders *Macrura* and *Anomala* are included, to the number of 169 species. The species of the suborder *Brachyura*, treated elsewhere, number 58; so that the total number of species of Decapod Crustacea collected by the "Investigator" in the depths of the seas of India, up to the end of the year 1900, amounts to 227.

This memoir, like the Catalogue of Investigator Deep-Sea Fishes published in 1899, is very far from being a mere reprint of earlier-published reports. In addition to tables and descriptions of species, it contains tables and definitions of all the genera and subgenera, families, tribes, and suborders under which the several species are arranged, and it embodies a large amount of material that I have prepared for the basis of a more comprehensive work on Indian Crustacea.

As most of the Crustacean types discovered by the "Investigator" have already been figured in the *Illustrations* published under the authority of the Director of the Royal Indian Marine, the only figures that are appended to this memoir are those of a few species that have escaped notice in that serial.

A. ALCOCK, Major, I.M.S.,  
*Superintendent of the Indian Museum.*



CORRIGENDA AND ADDENDA.

- Page 27 line 10 from bottom insert ' is ' after ' Smith '
- „ 39 „ 1 delete the second ' have '
- „ 45 „ 12 for ' it outer edge ' read ' its outer edge '
- „ 63 „ 2, 3rd column read ' Arthrobranchiæ ' for ' Pleurobranchiæ '  
 4th „ „ ' Pleurobranchiæ ' „ ' Arthrobranchiæ '
- „ 63 „ 8 from bottom for ' papilla or ' read ' papilla ou '
- „ 68 „ 13 for ' while is ' read ' which is '
- „ 93 „ 14 from bottom for ' expodite ' read ' exopodite '
- „ 131 „ 16 „ „ for ' Vol. XLIII ' read ' Vol. LXIII '
- „ 149 „ 15 „ „ for ' Salicoques at Galatheides ' read ' Salicoques et  
 Galatheides '
- „ 166 „ 21 for ' carapace in concave ' read ' carapace is concave '
- „ 203 After line 6 insert " This species is most closely related to *Gebia spinifrons*  
 Haswell."
- „ 204 „ 12 from bottom for ' A. M. Edw. ' read ' S. I. Smith '



## PART I. CRUSTACEA MACRURA.

### INTRODUCTION.

The Macrurous Decapod Crustacea included in this Catalogue were all of them dredged by the Royal Indian Marine Survey Ship "Investigator," in deep water, between the meridians of 65° and 99° E. and the parallels of 5° and 24° N., during the years 1885-1900.

They number 117 species, namely:—

<i>Peneidea</i>	...	...	...	...	27 species.
<i>Caridea</i>	...	...	...	...	58 "
<i>Stenopidea</i>	...	...	...	...	3 "
<i>Astacidea</i>	...	...	...	...	20 "
<i>Thalassinidea</i>	...	...	...	...	9 "

Of these 117 species, 69 are believed, for the present, to be proper to the seas of India, although it is highly probable that many of them will be found to have a wider range; while 48 are already known to occur in other seas.

Of the 48 widely-ranging species, 25 are known to inhabit the North Atlantic, and 29 the Pacific,—6 species being common to the Atlantic and Pacific—as is shown in the tables following.

Most of the species were dredged in less—usually considerably less—than 1000 fathoms: the only species taken from great depths are the following:—

<i>Aristæus (Hemipeneus) carpenteri</i>	...	...	...	1644	fathoms.
<i>Aristæus (Aristæopsis) armatus</i>	...	...	...	1748	"
<i>Sergestes rubroguttatus</i>	...	...	...	1748-1997	"
<i>Hoplophorus gracilirostris</i>	...	...	...	1439	"
<i>AcanthePHYra sanguinea</i>	...	...	...	1748	"
<i>AcanthePHYra microphthalmus</i>	...	...	...	1748	"
<i>Dorodotes reflexus</i>	...	...	...	1300-1644	"
<i>Pontophilus abyssii</i>	...	...	...	1748-1997	"
<i>Glyphocrangon cæcescens</i>	...	...	...	1748	"
<i>Pentacheles carpenteri</i>	...	...	...	1370-1540	"
<i>Willemoesia indica</i>	...	...	...	1310-1803	"

Of these, however, there can be no doubt whatever that *Aristæus carpenteri*, *Sergestes rubroguttatus*, *Hoplophorus gracilirostris*, and *AcanthePHYra sanguinea* were caught in the ascent of the trawl, for the very good reason that they are usually found in much shallower water, and that in the case of *Hoplophorus gracilirostris*, that species is often brought on board alive.

It is more than probable also that *Aristaeus armatus* and *Willemoesia indica* are meteoric (*i.e.* free-swimming or nectic) species.

So that it would appear as if, of the 117 species of Macrurous Crustacea known to inhabit the depths of the seas of India, only the following five are truly abyssal:—

*AcanthePHYra microphthalmus*, S. I. Smith.  
*Dorodotes reflexus*, Spence Bate.  
*Pontophilus abyssi*, S. I. Smith.  
*Glyphocrangon caescens*, Wood-Mason.  
*Pentacheles carpenteri*, Alcock.

I. List of deep-sea species of Macrurous Crustacea common to the ATLANTIC and the seas of INDIA.

[ The species marked (M) also occur in the Mediterranean. ]

- |   |   |
|---|---|
| 1. <i>Haliporus microps</i> , S. I. Smith.                                      | 13. <i>AcanthePHYra armata</i> , A. M. Edw.                                   |
| 2. <i>Aristæus</i> ( <i>Plesiopeneus</i> ) <i>edwardsianus</i> ,<br>Johns. (M). | 14. <i>Ephyrina hoskynii</i> , Wood-Mason.                                    |
| 3.        ,,      ( <i>Hepomadus</i> ) <i>tener</i> , S. I. Smith.              | 15. <i>Nematocarcinus cursor</i> , A. M. Edw.                                 |
| 4.        ,,      ( <i>Aristæopsis</i> ) <i>armatus</i> , Sp. Bate.             | 16. <i>Pandalus</i> ( <i>Plesionika</i> ) <i>martius</i> , A. M. Edw.<br>(M). |
| 5. <i>Benthesicymus bartletti</i> , S. I. Smith.                                | 17.         ,,         ,, <i>ensis</i> , A. M. Edw.                           |
| 6. <i>Gennadas parvus</i> , Sp. Bate.   | 18. <i>Chlorotocus gracilipes</i> , A. M. Edw. (M).                           |
| 7.         ,, <i>carinatus</i> (S. I. Smith).                                   | 19. <i>Heterocarpus ensifer</i> , A. M. Edw.                                  |
| 8. <i>Pasiphæa sivado</i> (Risso) (M).  | 20. <i>Pontophilus gracilis</i> , S. I. Smith.                                |
| 9. <i>Psathyrocaris fragilis</i> , Wood-Mason.                                  | 21.         ,, <i>abyssi</i> , S. I. Smith.                                   |
| 10. <i>Hopliphorus gracilirostris</i> , A. M. Edw.                              | 22. <i>Phoberus caecus</i> , A. M. Edw.                                       |
| 11. <i>AcanthePHYra eximia</i> , S. I. Smith.                                   | 23. <i>Nephropsis atlantica</i> , Norman.                                     |
| 12.         ,, <i>microphthalmus</i> , S. I. Smith.                             | 24. <i>Polycheles sculptus</i> , S. I. Smith.                                 |
|   | 25. <i>Calocaris macandree</i> , Bell (M).                                    |

II. List of deep-sea species of Macrurous Crustacea common to the PACIFIC and the seas of INDIA.

- |   |  |
|---|--|
| 1. <i>Peneus rectacutus</i> , Sp. Bate.   | 15. <i>Nematocarcinus gracilis</i> , Sp. Bate.                             |
| 2. <i>Haliporus aequalis</i> , Sp. Bate.  | 16. <i>Pandalus</i> ( <i>Plesionika</i> ) <i>unidens</i> , Sp. Bate.       |
| 3.         ,, <i>neptunus</i> , Sp. Bate.   | 17.         ,,         ,, <i>ocellus</i> , Sp. Bate.                       |
| 4. <i>Aristæus virilis</i> , Sp. Bate.  | 18.         ,,         ( <i>Parapandalus</i> ) <i>spinipes</i> , Sp. Bate. |
| 5.         ,, <i>semidentatus</i> , Sp. Bate.                                       | 19. <i>Heterocarpus gibbosus</i> , Sp. Bate.                               |
| 6.         ,,         ( <i>Aristæomorpha</i> ) <i>rostridentatus</i> ,<br>Sp. Bate. | 20.         ,, <i>lævigatus</i> , Sp. Bate.                                |
| 7.         ,,         ( <i>Aristæopsis</i> ) <i>armatus</i> , Sp. Bate.             | 21.         ,, <i>alphonsi</i> , Sp. Bate.                                 |
| 8. <i>Gennadas parvus</i> , Sp. Bate.   | 22.         ,, <i>ensifer</i> , A. M. Edw.                                 |
| 9. <i>Sergestes inous</i> , Faxon.  | 23. <i>Dorodotes reflexus</i> , Sp. Bate.                                  |
| 10. <i>AcanthePHYra microphthalmus</i> , S. I. Smith.                               | 24. <i>Glyphocrangon hastacauda</i> , Sp. Bate.                            |
| 11.         ,, <i>cristata</i> , Faxon.   | 25. <i>Nephrops thomsoni</i> , Sp. Bate.                                   |
| 12.         ,, <i>armata</i> , A. M. Edw.   | 26. <i>Nephropsis suhmi</i> , Sp. Bate.                                    |
| 13. <i>Nematocarcinus tenuipes</i> , Sp. Bate.                                      | 27. <i>Arctus orientalis</i> , Sp. Bate.                                   |
| 14.         ,, <i>tenuirostris</i> , Sp. Bate.                                      | 28. <i>Panulirus angulatus</i> , Sp. Bate.                                 |
|   | 29. <i>Calocaris macandree</i> , Bell.                                     |

III. *Species common to the ATLANTIC, the INDIAN OCEAN, and the PACIFIC.*

- |  |  |
|--|--|
| 1. <i>Gennadas parvus</i> , Sp. Bate.                | 4. <i>Acanthephyra microphthalmus</i> , S. I. Smith. |
| 2. <i>Aristæus (Aristæopsis) armatus</i> , Sp. Bate. | 5. „ <i>armata</i> , A. M. Edw.                      |
| 3. <i>Heterocarpus ensifer</i> , A. M. Edw.          | 6. <i>Calocaris macandreeæ</i> , Bell.               |

Most of the new species discovered by the “Investigator” have been figured in the *Illustrations of the Zoology of the Investigator* for the years 1892–1901, and have been described in the following papers:—

J. WOOD-MASON, *Ann. Mag. Nat. Hist.*, Feb., 1891, pp. 187–199; October 1891, pp. 269–286, Nov. 1891, pp. 353–362, April 1892, pp. 265–275, May 1892, pp. 358–370, Feb. 1893, pp. 161–172.

A. ALCOCK, *Ann. Mag. Nat. Hist.*, March 1894, pp. 225–242.

A. ALCOCK and A. R. S. ANDERSON, *Journ. Asiatic Soc. Bengal*, Vol. lxxiii. pt. 2, 1894, pp. 144–166, and *Ann. Mag. Nat. Hist.*, April 1899, pp. 278–292.

A. R. S. ANDERSON, *Journ. Asiatic Soc. Bengal*, Vol. lxxv. pt. 2, 1896, pp. 90–98.

A. F. McARDLE, *Ann. Mag. Nat. Hist.*, Nov. 1900, pp. 476–478.

A complete list of the species follows, with, in the case of the “new” species, the necessary references to the *Illustrations of the Zoology of the Investigator* in which they have been figured.



## LIST OF THE INDIAN DEEP-SEA MACRUROUS CRUSTACEA IN THE INDIAN MUSEUM.

[The references for the plates and figures are to the *Illustrations of the Zoology of the Investigator* for 1892-1901].

The species marked with an asterisk are those that are known to occur outside Indian limits.

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## CLASS CRUSTACEA: Order DECAPODA.

## Sub-order MACRURA, Dana.

Dana, U. S. Expl. Exped. Crust. pt. I. p. 497.

Although there are some *Anomala*, such as *Pylocheles*, and some *Macrura*, such as *Thalassina*, that occupy a sort of borderland between the *Macrura* and *Anomala*, and although in another direction there are some *Brachyura*, such as *Arachnodromia*, that almost cross the boundary line between the *Macrura* and *Brachyura*, yet I still think it more convenient to fall in with the older authors in recognizing three groups of Decapod Crustacea—MACRURA, BRACHYURA, and ANOMALA—than to follow Boas, who separates the Peneids and Caridids as NATANTIA and leaves all the other Decapods—*Brachyura*, *Anomala* and a large section of *Macrura*—together as REPTANTIA.

The MACRURA may be distinguished from all other Decapod Crustacea by the following characters:—

The body is elongate, the cephalothorax is less than half its total length, and the front is not fused with the epistome. The abdomen is large and symmetrical: it is more or less completely extended behind the cephalothorax and is never folded beneath it, and it ends in a symmetrical tail-fan the lateral lobes of which (caudal swimmerets) are almost without exception foliaceous.

Except in a very few forms, and those for the most part small pelagic and nectic species, the 4th and 5th pairs of thoracic legs are not reduced in size, nor are they ever folded within the branchial chambers.

The genital ducts never open on the sternum.

In addition the following points are characteristic of the sub-order, but are not invariably constant:—

The carapace is generally produced anteriorly into a rostrum and generally covers the ophthalmic somite.

The thoracic sternum is generally narrow.

The abdominal pleura, at any rate behind the 1st, are generally well developed: and the terga commonly overlap one another.

It is very unusual for the eyes to be lodged in orbits.

The antennular peduncle is generally rigid (*i.e.*, its joints not folded) and generally shorter than the flagella.

The antennal peduncle commonly has all 5 joints distinct and movable: its 2nd joint very often carries an exopodite, which is usually large and foliaceous (*antennal scale*), but is sometimes spiniform: the antennal flagellum is almost always very long.

The external maxillipeds are almost without exception elongate and pediform.

Epipodites are very often present on the first 4 pairs of thoracic legs, as well as on the maxillipeds.

As in the majority of Decapods, the 1st pair of thoracic legs are usually enlarged and chelate: the 2nd pair also are commonly chelate, and very often the 3rd pair as well.

It is usual for all the abdominal somites (telson, of course, excepted) to carry a pair of well developed appendages, and it is common to find a styliform *appendix interna* at the base of the endopodite.

The Macrura are here divided into two groups, characterized as follows:—

I. MACRURA CARIDIDES. Body and rostrum generally compressed: the carapace does not impinge upon the epistome antero-laterally: the abdomen is usually dorsally elbowed or humped: the pleura of the 1st abdominal somite are seldom reduced. The antennal scale is almost always large and foliaceous so as to entirely conceal the antennal peduncle.

II. MACRURA ASTACIDES. Body and rostrum not particularly compressed, sometimes decidedly depressed: the carapace impinges on, or articulates with, or is fused with the epistome antero-laterally: abdomen not humped: the pleura of the 1st abdominal somite are reduced. The antennal scale may be present or absent: if present, it may be foliaceous or spiniform: if foliaceous, it does not conceal the terminal joint of the antennal peduncle entirely.

### MACRURA CARIDIDES, DeHaan.

*Salicoques*, Milne Edwards, Hist. Nat. Crust. II. 269, 338.

*Macroura Carides*, DeHaan, Faun. Japon. Crust. p. 167.

*Caridea* et *Penæidea*, Dana, U. S. Expl. Exp. Crust. p. 501.

*Caridæ*, Heller, Crust. Sudl. Europ. p. 221.

*Natantia*, Boas, Vidensk. Selsk. Skr., 6 Række, naturvidenskabelig og matematisk Afd. I. 2, Kjobenhavn, 1880, p. 155: Ortmann in Broun's Thier-Reich, Arthropoda, pp. 1116, *et seq.*

*Stenopidea*, *Penæidea*, et *Phyllobranchiata Normalia*, Spence Bate Challenger Crust. Macrura, pp. 206, 220, 480.

*Stenopidea*, *Penæidea*, et *Caridea*, Stebbing, Hist. Crust. pp. 211, 213, 224.

Body generally compressed, rostrum generally compressed, integument very rarely strongly calcified. Abdomen symmetrical, long, bent or humped; telson usually acute, occasionally bluntly rounded off; the pleura of the 1st abdominal somite are not, or not much, reduced.

The basal joint of the antennular peduncle usually has a spine or scale ("stylocerite") at the proximal end of its outer margin: the olfactory setæ are confined to the proximal end of the outer antennular flagellum.

The antennal scale is almost always large, entirely concealing and projecting far beyond the antennal peduncle.



The external maxillipeds are pediform and are most often longer than the 1st pair of thoracic legs.

The thoracic legs all consist, usually but not always, of seven movable joints: the first two or three pairs may be chelate, but the last two pairs are never truly so: all 5 pairs are very often slender, but the 1st or the 2nd or the 3rd may be enlarged and massive: though the 4th and 5th pairs may occasionally (*Sergestidae*) be rudimentary or absent, they are never folded in the branchial chamber.

The abdominal appendages are particularly well developed, the 1st pair are often biramous.

The genital openings of the male are almost always in the articular membrane between the sternum and the coxa of the 5th pair of thoracic legs.

The branchiæ are dendrobranchiæ or phyllobranchiæ: only in one small group (*Stenopidea*) do they resemble trichobranchiæ.

*Synopsis of the Family-Groups of Macrura Caridides.*

- I. The 3rd pair of thoracic legs are chelate: the external maxillipeds are 7-jointed: the pleura of the 1st abdominal somite are not overlapped by those of the 2nd:—
  1. The 3rd pair of thoracic legs though they may be longer are not stouter than the 1st and 2nd pair: the mandibular palp is straight and usually foliaceous: the endopodite of the 1st maxillipeds is long: the branchiæ are dendrobranchiæ. PENEIDEA.
  2. One or both of the legs of the 3rd pair are not only longer but vastly stouter than those of the 1st and 2nd pair: the mandibular palp is stout and incurved: the endopodite of the 1st maxillipeds is short: the branchiæ resemble trichobranchiæ ... .. STENOPIDEA.
- II. The 3rd pair of thoracic legs are monodactylous: the external maxillipeds are 4- or 5-jointed: the pleura of the 1st abdominal somite are overlapped by those of the 2nd: the branchiæ are phyllobranchiæ... CARIDEA.

PENEIDEA, Spence Bate.

*Penéens* (part) Milne Edwards, Hist. Nat. Crust. II. 403.

*Peneidea* (part) DeHaan, Faun. Japon. Crust. p. 187 and Dana, U. S. Expl. Exp. Crust. pt. I. p. 600.

*Peneida*, Boas, Vid. Selsk. Skr., 6 Raekke, nat. math. Afd. I. 2, 1889, p. 155.

*Peneidea*, Spence Bate, Challenger Crust. Macrura, p. 220: Stebbing, Hist. Crust. p. 213: Ortmann, in Bronn's Thier Reich, Arthropoda, p. 1117.

The pleura of the 1st abdominal somite overlap those of the 2nd.

The incisor portion of the mandibles is separated from the molar portion by a groove: the endopodite (palp) of the mandibles is commonly very large and foliaceous or subfoliaceous.

The coxopodite of the 2nd maxillæ is cleft into two lobes, the distal one of which is prominent, the proximal one small and receding.

The endopodite of the 1st maxillipeds is long and sometimes five-jointed.

The last joint of the 2nd maxillipeds is a distinct dactylus, articulating end-on with the distal end of the propodite.

The external maxillipeds are distinctly seven-jointed.

The 3rd pair of thoracic legs are chelate—and often the 1st and 2nd pairs also.

The endopodites of the abdominal appendages from the 2nd to the 5th have no internal appendix at their base, except in the case of the 2nd pair of the male.

The branchiæ are dendrobranchiæ.

#### *Key to the families of Peneidea.*

- |   |     |     |     |     |                 |
|---|-----|-----|-----|-----|-----------------|
| I. The last two pairs of thoracic legs are well developed: the branchiæ are usually numerous  | ... | ... | ... | ... | PENEIDÆ.        |
| II. The last two pairs of thoracic legs are reduced in size, or rudimentary—one or both pairs are sometimes wanting: the branchiæ are never more than eight on either side and are sometimes absent |     |     |     |     | ... SERGESTIDÆ. |

#### Family *Peneidæ*, Spence Bate.

*Peneidæ*, Spence Bate, Challenger Crust. Macrura, p. 220: Stebbing, Hist. Crust. p. 213: Ortmann, in Bronn's Thier Reich, Arthropoda, p. 1118.

Rostrum usually well developed, laterally compressed: ophthalmic somite little exposed.

The basal joint of the antennular peduncle is dorsally concave for the eye and is strengthened at base, on the outer side, by a spine-like scale: the antennular flagella are two in number. The antennal scale is broadly foliaceous.

The first three pairs of thoracic legs are chelate, the 4th and 5th pairs are well developed. Exopodites may be present on some or all of the thoracic legs, or may be entirely absent.

The epipodite of the 2nd maxillipeds is large. The branchiæ are numerous.

The *Peneidæ* may be divided into 3 subfamilies (excluding the claims of the larval form known as *Cerataspis*), as follows:—

I. PENEINÆ. A long setose leaf-like appendage, acting as a sort of protection to the eye, is present on the inner border of the basal joint of the antennular peduncle. Exopodites are present on the 2nd maxillipeds, and usually also on the 3rd; they are usually present on the thoracic legs, but are sometimes absent from some or all of them. Podobranchiæ are never present

on the thoracic legs (only in some species of *Haliporus* is there a rudimentary podobranch on the 1st pair). Arthrobranchiæ in a double series.

II. *ARISTÆINÆ*. No leaf-like appendage on the inner border of the basal joint of the antennular peduncle. Exopodites are present on the 1st and 2nd maxillipeds, but are usually absent—or, if present, are of very small size, on the thoracic legs. Podobranchiæ are present on the first two or three pairs of thoracic legs. Arthrobranchiæ in a double series.

III. *SICYONINÆ*. No leaf-like appendage on the inner border of the basal joint of the antennular peduncle. No exopodites to any of the thoracic appendages behind the 1st maxillipeds. No podobranchiæ. Arthrobranchiæ in a single series.

*Key to the genera and sub-genera of Peneidæ of the Indian Necton.*

- I. The inner border of the 1st segment of the antennular peduncle carries a twisted setose scale that forms an incomplete inner wall to the orbit. No podobranchiæ on any of the legs:—
  1. Antennular flagella cylindrical:—
    - i. The 2nd joint of the mandibular palp is vastly larger than the 1st and forms almost the whole palp: the exopodites of the external maxillipeds are large ... .. *PENEUS*.
    - ii. The 1st joint of the mandibular palp is a good deal larger than the 2nd: exopodites of the external maxillipeds rudimentary or absent ... .. *HALIPORUS*.
  2. Antennular flagella thin, broad, compressed: (the 2nd joint of the mandibular palp much larger than the 1st: exopodites of the external maxillipeds very short and slender):—
    - i. The sub-foliaceous antennular flagella are truncated ... .. *SOLENOCERA*.
    - ii. The sub-foliaceous antennular flagella gradually taper to a lash ... .. *PARASOLENOCERA*.
- II. The scale on the inner border of the 1st segment of the antennular peduncle is absent or quite rudimentary. Podobranchiæ are present on the first 2 or 3 pairs of legs:—
  1. The outer (upper) anteunular flagellum is extremely short, the inner (lower) flagellum is long: the 1st joint of the mandibular palp is much longer than the 2nd, but though it is compressed and broad, it is not foliaceous:—
    - i. No hepatic spine: rostrum dorsally 3-toothed (rarely 2-4 toothed):—
      - a. The 3rd pair of legs have an epipodite but no podobranch, the 4th pair have no epipodite:—
        - a. Cervical groove indistinct: the pleurobranchiæ in advance of somite xiv are mere filaments or papillæ ... .. *ARISTÆUS*.
        - β. Cervical groove fine but conspicuous: the pleurobranchiæ in advance of somite xiv, though small and slender, are plumose and functional ... .. *HEMIPENEUS*.



- b. The 3rd pair of legs have an epipodite and a podobranch, the 4th pair have an epipodite:—
- a. Exopodites of the 2nd maxillipeds much longer than the endopodites: pleurobranchiæ small and slender but plumose ... .. PLESIOPENEUS.
- β. Exopodites of the 2nd maxillipeds very much shorter than the endopodites: pleurobranchiæ large ... .. ARISTÆOPSIS.
- ii. An hepatic spine:—
- a. The 3rd pair of legs have an epipodite, but no podobranch, the 4th pair have no epipodite ... HEPOMADUS.
- b. The 3rd pair of legs have an epipodite and a podobranch, the 4th pair have an epipodite: *rostrum many-toothed dorsally* ... .. ARISTÆOMORPHA.
2. Both the antennular flagella are long: the first joint of the mandibular palp is distinctly foliaceous (and is much longer and broader than the 2nd joint):—
- i. The endopodites of the 2nd maxillipeds are of the usual subpediform shape ... .. BENTHESICYMUS.
- ii. The merus of the 2nd maxillipeds is a thin oval leaf completely concealing the next 3 joints when they are flexed ... .. GENNADAS.

### Subfamily *Peneinæ*.

#### PENEUS, Fabr.

*Peneus* Fabricius Ent. Syst. Suppl. p. 408: Milne Edwards, Hist. Nat. Crust. II. 411 (*ubi synonym.*): Spence Bate, Challenger Crustacea Macrura, p. 229.

Carapace with a well developed rostrum, which may be toothed dorsally and ventrally, or dorsally only. Abdomen long, with some of the posterior somites compressed and carinated. Eyes large and subglobular.

The basal joint of the antennule is hollowed dorsally for the reception of the eye, its outer edge is produced anteriorly into a spine, and from the proximal end of its inner edge there springs a conspicuous twisted setose scale. The antennular flagella are cylindrical: they are commonly subequal in length and either short or not very long, but occasionally one of them is much elongated (*e. g.* subgenus *Xiphopeneus*).

Antennal scale large, the outer edge rigid and anteriorly acute: antennal flagellum long.

The mandibular palp is large and broadly foliaceous, its 2nd joint is vastly larger than its 1st. The palp of the 1st maxillæ commonly ends in a little, distinctly articulated, flagellum.

The exopodite of the external maxillipeds is a compressed stiffish joint, as long as, and quite similar to, that of the 2nd maxillipeds.

The external maxillipeds are pediform. The first three pairs of thoracic legs are chelate, the 1st pair being the shortest and the 3rd pair the longest. The last two pairs of legs are monodactylous. Exopodites are usually present on all, or all but the last thoracic legs, but are sometimes entirely wanting.

The abdominal appendages are of moderate length, the exopodite being longer than the endopodite, and they may be either foliaceous or slender. In the first pair no endopodite is present, but in the male its place is occupied by a "petasma" or "andricum" which is usually a good deal pleated and is sometimes convoluted. In the second pair the endopodite, in the male, carries at its base a little fleshy scale.

No podobranchiæ are present on any of the legs. Pleurobranchiæ are present on all, or on all but the last one or two, of the last 7 thoracic somites.

The genus *Peneus* may be divided into six subgenera as follows:—

I. *PENEUS* (restr.) S. I. Smith, Proc. U. S. Nat. Mus., VIII. 1885, p. 170. Rostrum toothed both ventrally and dorsally. A pleurobranch is present on somite XIV. Epipodites on all the thoracic appendages except the last two. Exopodites present on all, or all but the last, pair of legs. Antennular flagella short. TYPE *P. caramote*, Risso.

II. *PARAPENEUS*, S. I. Smith, Proc. U. S. Nat. Mus. VIII. 1885, p. 170. Rostrum toothed dorsally only. No pleurobranch on the last thoracic somite (XIV). Epipodites absent from the external maxillipeds as well as from the last two pairs of legs. No exopodites to any of the legs. Antennular flagella short. [The carapace is sometimes fissured (1) longitudinally, from the orbital to, or nearly to, the posterior margin, and (2) transversely, through the branchiostegite.] TYPE *P. membranaceus* Heller.

III. *METAPENEUS*, Wood-Mason, Ann. Mag. Nat. Hist., Oct. 1891, p. 271. As *Parapeneus*, except that all the legs, or all but the last pair, have exopodites. [The carapace is never fissured, and there may be a filamentous vestige of an anterior arthrobranch on somite XIII.] TYPE *P. affinis*, Edw.

IV. *PARAPENEOPSIS*, Wood-Mason MS. name only. Rostrum toothed dorsally only. No pleurobranchiæ on the last two thoracic somites (XIII and XIV). Epipodites absent from the external maxillipeds as well as from the last three pairs of legs. Exopodites present on all the legs. Antennular flagella longish. The carapace is fissured on either side (1) longitudinally, from the orbital to, or nearly to, the posterior margin, and (2) transversely, through the branchiostegite. TYPE *P. styliferus*, Edw.

V. TRACHYPENEUS, *nov.* Rostrum toothed dorsally only. No pleurobranchiæ on the last two thoracic somites. Epipodites absent from the external maxillipeds as well as from the last two pairs of legs. Exopodites present on all, or all but the last pair, of legs. Antennular flagella moderately long. The carapace is longitudinally fissured in the post-orbital region on either side. TYPE *P. anchoralis* Sp. Bte.

VI. XIPHOPENEUS, S. I. Smith, Proc. U. S. Nat. Mus., VIII. 1885, p. 188. Rostrum toothed dorsally only. No pleurobranchiæ on the last two thoracic somites. Epipodites absent from the external maxillipeds as well as from the last two pairs of legs. Exopodites present on all the legs (those of the last pair very small). Antennular flagella long. The carapace is fissured longitudinally on either side from the orbital nearly to the posterior margin. The last two pairs of thoracic legs are very long and flagelliform. TYPE *P. Kroyeri* Heller.

The above arrangement is founded on a study of the material in the British Museum.

The deep-sea species of *Peneus* collected by the Investigator all belong to the subgenera *Metapeneus* and *Parapeneus*, and have the following branchial formula:—

Somites and Ap- pendages.	Podobranchiæ.	Arthrobranchiæ.		Pleurobranchiæ.
		Anterior.	Posterior.	
VII.	0 (ep.)	0	(r.)	0 = r+ep.
VIII.	1 (ep.)	1	1	0 = 3+ep.
IX.	0	1	1	1 = 3
X.	0 (ep.)	1	1	1 = 3+ep.
XI.	0 (ep.)	1	1	1 = 3+ep.
XII.	0 (ep.)	1	1	1 = 3+ep.
XIII.	0	0	1	1 = 2
XIV.	0	0	0	0 = 0
<hr/>				
Total.	1+5 ep.	5	6(+r)	5 = 17(+r)+5 ep.

#### *Synopsis of the Indian Deep-sea species of Peneus.*

- I. Rostrum in both sexes much more than half the length of the rest of the carapace measured in the mid-dorsal line: carapace not longitudinally fissured:—

1. Tomentose: upper edge of free portion of rostrum with 6 or 7 teeth: lobes of copulative organ of the first pair of male abdominal appendages unequal:—

- i. Fourth and fifth abdominal terga distinctly subcarinate on either side of the median carina ... .. *P. coniger.*
- ii. Fourth and fifth abdominal terga obscurely angulated on either side of the median carina ... .. *P. coniger* var. *andamanensis.*

2. Glabrous, upper edge of free portion of rostrum with 12 or 13 teeth: lobes of copulant organ of first pair of male abdominal appendages equal ... .. *P. rectacutus*.
- II. Rostrum in both sexes less than half the length of the rest of the carapace measured in the mid-dorsal line: a fine fissure traverses the carapace longitudinally, on either side, from a point just inside the antennal spine, to the posterior border ... .. *P. investigatoris*.

### 1. *Peneus (Metapeneus) coniger*, Wood-Mason.

*Metapeneus coniger*, Wood-Mason, Ann. Mag. Nat. Hist., October, 1891, p. 272.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE L, FIGS. 2, 2a, 2b.

Tomentose. Rostrum with a faint double curve, armed dorsally with 6 or 7 teeth in addition to a tooth on its gastric carina: in the female its free portion is over three-quarters the length of the rest of the carapace measured in the mid-dorsal line, and its tip reaches well beyond the far end of the antennular peduncle, but in the male its tip falls short of the end of the antennular peduncle: the rostrum is produced backwards as a distinct carina only in the anterior half of the carapace. Cervical groove indistinct.

Abdominal terga, from the 2nd to the end of the 6th, with a median carina, indistinct and incomplete on the 2nd, increasingly sharp and distinct to the 6th, where it ends in a spine. The 4th, 5th, and 6th terga are distinctly subcarinate on either side of the median carina. 6th somite at least twice the length of the 5th. Telson a good deal shorter than the endopodite of the caudal swimmeret, slender, acute, armed on either side in its posterior half with four spines the last of which alone is fixed.

Eyes large. Inner antennular flagellum hardly as long as the antennular peduncle, much longer than the outer flagellum: in the male only, the inner-upper border of the base of the inner flagellum is slightly concave up to a small denticle. Antennal scale as long as the rostrum in the male, but not quite as long in the female.

Second joint of the mandibular palp (endopodite) tomentose, nearly as broad as long.

There is a spine at the far end of the basis and ischium of the first pair of thoracic legs. Between the 2nd pair of thoracic legs, in the female, is a pair of small sternal teeth.

The posterior border of the "thelycum" is not undermined and is curved like a  $\omega$  reversed, the middle limb of the  $\omega$  being very short and narrow.

The "andricum" of the first pair of abdominal appendages is about a third as long as the carapace (without the rostrum), and is strongly calcified at tip: its left lobe, which is folded round a tubular spiral process of the right lobe, is longer than the right lobe.



The rostrum and carapace of the largest specimen are 39 millim. long; the abdomen fully-extended, is 54 millim. long, the measurements being taken in the mid-dorsal line.

Common off the Coromandel coast in 68–250 fathoms, also found off the Malabar coast in 124–119 fathoms.

This species is as closely as possible related to *P. philippinensis* Sp. Bate, with specimens of which I have compared it. The only differences between the two species are the following:—in *P. philippinensis* the rostrum is straighter, there is no angulation of the 4th and 5th abdominal terga on either side of the median carina, there is no tooth (though there is a slight concavity) near the base of the inner antennular flagellum on its inner-upper border, and though the posterior border of the “thelycum” is curved something like a  $\omega$  the middle limb of the  $\omega$  is long broad and square-cut.

Regd. Nos.  $\frac{4174}{9}$ :  $\frac{4206}{9}$  (Types of the species):  $\frac{4175-4205}{9}$ :  $\frac{4207-4230}{9}$ :  $\frac{7064-7078}{9}$ :  
 $\frac{7368-7380}{9}$ :  $\frac{9120-9130}{9}$ :  $\frac{9184-9200}{9}$ :  $\frac{3398}{10}$ :  $\frac{3401}{10}$ .

*Peneus (Metapeneus) coniger* var. *andamanensis* Wood-Mason.

*Metapeneus philippinensis* var. *andamanensis*, Wood-Mason, Ann. Mag. Nat. Hist., Oct. 1891, p. 271.

This variety differs from *P. coniger* in the following particulars *only*:—

(1) the rostrum, though uptilted, is nearly straight: (2) the subearinae on either side of the median carina of the 4th and 5th abdominal terga are indistinct: (3) the posterior border of the “thelycum” is deeply undermined, it is curved like a  $\omega$  reversed, but the middle limb of the  $\omega$  is long and very broad and recurved at its free end: (4) the “andrium” of the 1st abdominal appendages is at least half as long as the carapace (without the rostrum).

In the largest specimen the rostrum and carapace are 50 millim. long and the extended abdomen is 76 millim. long, measured in the mid-dorsal line.

Common in the Andaman Sea between 100 and 244 fathoms: also taken once, in large number, off Cape Comorin in 143 fathoms.

Regd. Nos.  $\frac{2087-2105}{10}$  (Types of the species):  $\frac{7381-7385}{9}$ :  $\frac{3403}{10}$ :  $\frac{3531}{10}$ .

2. *Peneus (Parapeneus) rectacutus*, Sp. Bte.

*Peneus rectacutus*, Spence Bate, Challenger Crustacea Macrura, p. 266, pl. xxxvi. fig. 2, ♀.

*Metapeneus rectacutus*, Wood-Mason, Ann. Mag. Nat. Hist., Oct. 1891, p. 274: Alcock and Anderson, Journ. As. Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 145.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLIX. FIG. 5, ♂.

Glabrous. Rostrum with a very slight double curve, armed dorsally with 12 or 13 teeth not including a tooth on its gastric carina: in the female its free portion is not quite three-quarters the length of the rest of the carapace measured in the mid-dorsal line and its tip reaches to the far end of the antennular peduncle, but in the male its tip falls short of the end of the antennular

peduncle: the rostrum is produced backwards as a distinct carina only in the anterior half of the carapace. The cervical groove and its posterior branch are deep-cut on the sides of the carapace: a sinuous longitudinal ridge is very prominent on either epibranchial region.

The abdomen begins to be indistinctly carinate, in the mid-dorsal line, at the after end of the 3rd tergum, but the carina becomes very sharp on the 4th, 5th, and 6th terga and ends in a spine. The 6th abdominal somite is considerably less than twice the length of the 5th. The telson is a trifle longer than the endopodite of the caudal swimmeret: it is armed on either side with 4 spines, the last of which is fixed.

Eyes large. In the female the antennular flagella are about equal and are a little longer than their peduncle: in the male the inner flagellum is about as long as its peduncle and very much shorter than the outer flagellum. Moreover in the male the basal end of the inner flagellum is bent downwards to form a rigid semicircular hoop twisted inwards at its far end where the hoop ends in a strong recurved tooth. In both sexes the antennal scale is about as long as the rostrum.

The 2nd joint of the palp (endopodite) of the mandible is very thin, glabrous, and about as broad as long.

There is a spine at the far end of the ventral border of the basis and ischium of the 1st pair of thoracic legs, and in the female a spine also on the basis of the 2nd pair.

The "thelycum" is trilobed with the anterior (median) lobe nearly semicircular: the space between the lateral lobes is excavated and is bounded posteriorly by a tubercle.

The "andricum" of the 1st pair of abdominal appendages consists of a pair of equal leaves, which simply form a canal by their interlocking, and are not mutually involuted as they are in *P. coniger*.

The rostrum and carapace of the largest female are 52 millim., the extended abdomen is 79 millim., measured in the mid-dorsal line.

Not uncommon in the Bay of Bengal, off the Malabar coast, at 145 to 220 fathoms: also at the northern end of the Andaman Sea, in 370-419 fathoms.

Regd. Nos.  $\frac{6730-6731}{9}$ :  $\frac{9131-9180}{9}$ :  $\frac{2589-2595}{10}$ .

### 3. *Peneus (Parapeneus) investigatoris*, Anderson.

*Parapeneus investigatoris*, Alcock and Anderson, Ann. Mag. Nat. Hist., April 1899, p. 279.

*Parapeneus fissurus*, Alcock and Anderson (*nee* Spence Bate), Journ. As. Soc. Beng. Vol. LXIII, pt. 2, 1894, p. 141.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLI. FIGS. 1, 1a-b.

Glabrous, polished. Rostrum a little convex dorsally, its dorsal border with 6 or 7 teeth not including one on its gastric carina: in the female its free portion

is less than half the length of the rest of the carapace, measured in the mid-dorsal line, and its tip reaches a little beyond the basal joint of the antennular peduncle, but in the male it does not quite reach the end of that joint: the rostrum is produced backwards as a carina for more than two-thirds the length of the carapace.

The grooves that join the hepatic with the antennal and branchiostegal spines are very distinct: a fine fissure runs along the whole length of the carapace on either side, from a point just inside the antennal spine to the posterior border: an even finer fissure runs vertically across the branchiostegal flap, in its posterior third.

The 4th, 5th and 6th abdominal terga are sharply carinated in the middle line, each carina ending in a spine. The 6th abdominal somite is more than twice as long as the 5th. The telson is a good deal shorter than the endopodite of the caudal swimmeret and carries a pair of fixed lateral spines near its apex.

Eyes of moderate size. The antennular flagella are nearly equal in length in both sexes and are longer than their peduncle: in the male they are not in any way modified for prehension as they are in the three preceding species.

The 2nd joint of the mandibular palp is broad and setose. There is a very strong spine at the end of the ventral border of the basis and ischium of the 1st pair of thoracic legs.

The "thelycum" is trilobed, the anterior (median) lobe being nearly semi-circular: between the lateral lobes is anteriorly a deep hollow, and posteriorly a tubercle.

The "andricum" of the 1st pair of abdominal appendages is formed of two equal leaves which are much fimbriated at their free end; they are not mutually involuted but form a simple canal by their interlocking.

In the largest female the rostrum and carapace are 28 millim. long, and the extended abdomen is 54 millim. long, measured in the mid-dorsal line.

Bay of Bengal, off Coromandel coast, 678 fathoms: Gulf of Manár, 180-217 fathoms: Andaman Sea, off the North island 185 to 419 fathoms.

This species though undoubtedly near-related to *P. fissurus* is distinguished at first sight by the elongate 6th abdominal somite, and by the short dorsally-convex rostrum.

Regd. Nos.  $\frac{2080-2086}{10}$  (Types of the species):  $\frac{9181-9183}{9}$ :  $\frac{808-809}{10}$ :  $\frac{2596-2604}{10}$ .

#### SOLENOCERA, Lucas.

This genus differs most markedly from *Peneus* in the form of the antennular flagella, which are foliaceous and channelled along the inner surface, so that when apposed together from opposite sides they form a tube: the inner flagella form the outer walls of the tube and thus ensheath the outer flagella.

It also differs from *Peneus* in having an epipodite to all the thoracic appendages except the last, and in having a pair of arthrobranchiæ, instead of only a single (posterior) arthrobranch to the penultimate thoracic somite (XIII).

So far as Indian species of both genera go, *Solenocera* further differs from *Peneus* in the slender, filamentous, almost rudimentary form of the exopodites of the 2nd and 3rd maxillipeds.

The branchial formula is as follows :—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.		Pleurobranchiæ.
		Anterior.	Posterior.	
VII	0 (ep.)	0	0	0 = 0 + ep.
VIII	1 (ep.)	1	1	0 = 3 + ep.
IX	0 (ep.)	1	1	1 = 3 + ep.
X	0 (ep.)	1	1	1 = 3 + ep.
XI	0 (ep.)	1	1	1 = 3 + ep.
XII	0 (ep.)	1	1	1 = 3 + ep.
XIII	0 (ep.)	1	1	1 = 3 + ep.
XIV	0	0	0	1 = 1
Total	1 + 7ep.	6	6	6 = 19 + 7 ep.

#### 4. *Solenocera Hextii*, Wood-Mason.

*Solenocera Hextii*, Wood-Mason, Ann. Mag. Nat. Hist., Jan. 1891, p. 188, and Oct. 1891, p. 275; Alcock and Anderson, Journ. As. Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 145.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XXVI. FIG. 5.

Glabrous, polished. Rostrum deep, ascendant, armed dorsally with 7 teeth, produced as an extremely well-marked carina almost to the posterior border of the carapace, its tip, in both sexes, reaches only to the end of the basal joint of the antennular peduncle.

Cervical groove and its tributaries deep-cut, interrupted only at the rostral carina. A very deep-cut L-shaped groove—with the posterior limb parallel with the postrostral carina—on either branchiostegal region.

The spines of the carapace, in addition to an acute orbital angle, are a post-orbital, an antennal, a hepatic, and one on the cervical groove behind and above the hepatic.

Abdominal terga sharply carinated from behind the anterior fourth of the 3rd to the end of the 6th. The 6th abdominal somite is not, or hardly, longer than the 5th: the telson is about equal in length to the endopodite of the caudal swimmeret and is "trifurcate."

Eyes large. Antennular flagella about two-thirds the length of the carapace (without rostrum) measured in the mid-dorsal line; though they are



exceedingly broad and spathulate, and though the inner flagellum ensheathes the outer, they are hardly deeply enough channelled to form a tube by their apposition.

The exopodite of the external maxilliped is not much more than half the length of the ischium of the endopodite and is hardly larger than the exopodites of the legs. The exopodite of the 2nd maxillipeds is also small and filamentous, being shorter than the merus of the endopodite.

The "thelycum" is not at all conspicuous. The "andricum" of the 1st pair of abdominal appendages consists of two equal lobes forming a canal by their apposition.

In the largest female the carapace and rostrum are 46 millim. in length, the extended abdomen is 69 millim. in length measured in the mid-dorsal line.

Colour in life, bright pink.

Bay of Bengal from Chittagong to near Madras, 65 to 276 fathoms: Arabian Sea, from the Indus Delta to the Malabar coast, 108 to 124 fathoms.

Regd. Nos.  $\frac{4266-4269}{7}$ :  $\frac{4278}{7}$ :  $\frac{4280-4288}{7}$ :  $\frac{7049-7063}{9}$  (Types of the species):  $\frac{6729}{9}$ :  
 $\frac{8485-8486}{9}$ :  $\frac{326-332}{10}$ :  $\frac{804-805}{10}$ :  $\frac{1164}{10}$ :  $\frac{3399}{10}$  (many specimens).

#### Subgenus PARASOLENOCERA, Wood-Mason.

*Parasolenocera*, Wood-Mason, Ann. Mag. Nat. Hist., Oct. 1891, p. 276.

The number and disposition of the branchiæ and epipodites, and the almost rudimentary character of the exopodites of the 2nd and 3rd maxillipeds, are exactly as in *Solenocera*, from which *Parasolenocera* differs only in the following minor characters:—(1) the foliaceously-expanded antennular flagella, though otherwise as in *Solenocera*, gradually taper to a filament, instead of being truncated or abruptly acuminate: (2) the 2nd and 3rd abdominal terga form a distinct hump.

#### 5. *Solenocera (Parasolenocera) annectens*, Wood-Mason.

*Parasolenocera annectens*, Wood-Mason, Ann. Mag. Nat. Hist., Oct. 1891, p. 276.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLIX. FIG. 6.

Glabrous, polished. Rostrum strongly ascendant, armed dorsally with 7 teeth not including one on the gastric region, not produced backwards as a carina farther than the middle of the carapace, its tip reaches to the end of the 2nd joint of the antennal peduncle.

Cervical groove deep, interrupted only at the gastric carina: branchial regions defined dorsally by a sinuous groove.

The spines of the carapace, in addition to a small tooth at the orbital angle, are a post-orbital, an antennal, an hepatic, and a branchiostegal, the last being more an acute lobule than a spine.

The abdominal terga are sharply carinated from the anterior end of the 3rd to the posterior end of the 6th. The 6th abdominal somite is between a half and a third again as long as the 5th. The telson is longer than the endopodite, longer even than the exopodite, of the caudal swimmeret and is trifurcate.

Eyes rather large. Antennular flagella as long as the carapace *plus* half the rostrum, measured in the mid-dorsal line, foliaceous in the greater part of their extent, but gradually tapering to a filament. As in the previous species the flagella are lightly channelled and the inner is twisted at base so as to ensheathe the outer.

In the unique specimen the carapace and rostrum are 26 millim. long, and the abdomen is 40 millim.

Colour in life, red.

From the Andaman Sea, off the South island, 405 fathoms.

Regd. No.  $\frac{6727}{9}$  (Type of the species).

#### HALIPORUS, Spence Bate.

*Haliporus*, Spence Bate, Ann. Mag. Nat. Hist., Sept. 1881, and Challenger Crustacea Macrura, p. 284.

*Hymenopeneus*, S. I. Smith, Proc. U. S. Nat. Mus., 1885, p. 179.

Differs from *Peneus* in the following characters:—

The carapace is usually, but not always, submembranous, and is always armed with at least four teeth on either side, namely, a supra-orbital, an antennal, a true branchiostegal, and a hepatic. (The rostrum is toothed dorsally only, as in all the subgenera of *Peneus* excepting *Peneus* itself).

The antennular flagella, one or both, are very long. The eyestalk has a small tubercle on its inner face.

The mandibular palp (endopodite) has the first joint long broad and ovate, and the second joint long (though shorter than the first) slender and pointed.

The exopodite of the 2nd maxillipeds is short and slender, and that of the third (external) maxillipeds is rudimentary or absent. (There are small exopodites to all the thoracic legs).

The functional branchiæ are 19 on either side arranged as in *Solenocera*, and there are epipodites on all the thoracic appendages except the last.

The branchial formula is as follows:—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.		Pleurobranchiæ.	
		Anterior.	Posterior.		
VIII.	1 (ep.)	1	1	0	= 3+ep.
IX.	(ep.)	1	1	1	= 3+ep.
X.	(ep.)	1	1	1	= 3+ep.
XI.	(ep.)	1	1	1	= 3+ep.
XII.	(ep.)	1	1	1	= 3+ep.
XIII.	(ep.)	1	1	1	= 3+ep.
XIV.	0	0	0	1	= 1
Total	1+6 ep.	6	6	6	19+6 ep.

### Synopsis of the Indian species of Haliporus.

- I. Integument thin but firm, glabrous: last two pairs of thoracic legs very long, flagelliform. Size moderate or small:—
  1. Last pair of thoracic legs at least as long as the entire body from tip of rostrum to tip of telson:—
    - i. Eyes large, their major diameter at least twice that of the eyestalk: rostral carina quite indistinct behind the gastric region. Colour in life pink ... .. *H. æqualis.*
    - ii. Eyes small, their major diameter not nearly twice that of the eyestalk: rostral carina quite distinct to near the posterior edge of the carapace. Colour bright orange ... .. *H. neptunus.*
  2. Last pair of thoracic legs as long as the distance from the tip of the rostrum to halfway along the fifth abdominal tergum: eyes little wider than their stalk. Colour in life dark purple ... .. *H. microps.*
- II. Last two pairs of thoracic legs stout, long, but not flagelliform. Size large:—
  1. Integument leathery, glabrous ... .. *H. taprobanensis.*
  2. Integument membranous, flaccid, densely though finely hirsute ... .. *H. villosus.*

### 6. *Haliporus æqualis*, Spence Bate.

*Haliporus æqualis*, Spence Bate, Challenger Crustacea Macrura, p. 285, pl. xli. fig. 1: Wood-Mason, Ann. Mag. Nat. Hist., Oct. 1891, p. 277.

Glabrous. Rostrum straight, moderately ascendant, not reaching to the end of the 2nd joint of the antennular peduncle, its free portion less than half the length of the rest of the carapace measured in the mid-dorsal line, its carina, though just traceable to the posterior border of the carapace, is extremely indistinct behind the gastric region: the rostrum is armed dorsally with 7 or 8, rarely 9, teeth, two of which, on the gastric carina, are remote from the others. The cervical groove is distinct almost up to the gastric carina: the groove defining

the branchial region superiorly and the ridge defining the branchial channel are very distinct.

The 4th, 5th and 6th abdominal terga are sharply carinated: the 6th abdominal somite is about half again as long as the 5th. Telson "trifurcate," shorter than the endopodite of the caudal swimmeret.

Eyes large, reniform, their major diameter at least twice that of their stalk.

Outer antennular flagellum more than twice as long as the inner, and at least as long as the entire body.

External maxillipeds about as long as the third pair of thoracic legs. Last two pairs of legs flagelliform, the last, which is a little the longer of the two, being at least as long as the entire body.

The tubercles that carry the openings of the oviducts are of very large size and hirsute: behind them the "thelycum" is formed (1) by a transverse sternal crescentic plate bounded posteriorly by (2) a pair of transverse processes derived from the coxæ of the 4th pair of legs, which are followed (3) by a median sternal shield-shaped tubercle, behind which is (4) the concave posterior edge of the sternum, notched in the middle line.

The "andricum" of the first pair of abdominal appendages is a pair of equal lobes that form a canal by their interlocking: each lobe ends in two rounded lobules of slightly unequal size the inner of which is nicked at tip, and as the outer lobule is notched at base there is an appearance of a third lobule further back.

In the largest female the carapace is 34 millim. long (rostrum included) and the extended abdomen 51 millim. long, the measurements being in the mid-dorsal line.

Colours in life, pink.

Not uncommon in the Andaman Sea from 250 to 500 fathoms, Arabian Sea 406 to 703 fathoms, and off Ceylon 195 to 597 fathoms.

It seems to me more than doubtful whether this species is really distinct from Spence Bate's *Haliporus obliquirostris*.

Regd. Nos.  $\frac{8521}{6}$ :  $\frac{8574}{6}$ :  $\frac{4271-4272}{7}$ :  $\frac{3116-3117}{9}$ :  $\frac{3173}{9}$ :  $\frac{3192}{9}$ :  $\frac{6720-6726}{9}$ :  $\frac{9274}{9}$ :  $\frac{291-296}{10}$ :  
 $\frac{507-510}{10}$ :  $\frac{1483}{10}$ .

### 7. *Haliporus neptunus*, Spence Bate.

*Haliporus neptunus*, Spence Bate, Ann. Mag. Nat. Hist., Sept. 1881, p. 185, and Challenger Crustacea Maorura, p. 291, pl. xlii, fig. 3: Wood-Mason, Ann. Mag. Nat. Hist., Oct. 1891, p. 278.

This species agrees at almost all points with *H. æqualis*, from which it may be distinguished by the following characters:—

The rostral carina is continued backwards as a distinct carina nearly to the



posterior border of the carapace. The eyes are smaller, their diameter being not nearly twice that of the eyestalk. The tubercles that carry the openings of the oviducts are perhaps even larger, and the thelycum differs, the most conspicuous difference being the replacement of the large shield-shaped tubercle by a narrow pointed tubercle. The lobes of the "andricum" end in three sharpish lobules of not very unequal size.

Colour in life bright orange, in spirit rusty yellow.

Bay of Bengal at 1644 and 1748 fathoms.

Regd. Nos.  $\frac{6718-6719}{9}$ .

### 8. *Haliporus microps*, (S. I. Smith).

*Hymenopeneus microps*, S. I. Smith, Albatross Crustacea, 1884, p. 69, pl. x. fig. 1, and 1886, pl. xvi. fig. 8, and Ann. Mag. Nat. Hist. (5) xvii. 1886, p. 189; Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 188.

The only differences between this species and *H. æqualis* are the following:—

The eyes are small, being hardly wider than the eyestalk. The last 2 pairs of thoracic legs, though equally filamentous, are shorter, the last pair being as long as the carapace and rostrum together with the first five-and-a-half abdominal terga. The three lobules at the free end of the lobes of the "andricum" are very unequal in size, though the inner one is nicked at the tip in the same way.

Colour in life purple-black, the eyes very black; colour in spirit reddish or brownish.

In our largest specimen the rostrum and carapace together measure 26 millim., and the extended abdomen 40 millim., in the mid-dorsal line.

Arabian Sea 480 to 1070 fathoms. Bay of Bengal, near the Andamans, 561 fathoms.

Regd. Nos.  $\frac{6145-6147}{9}$ :  $\frac{6728}{9}$ :  $\frac{9201}{9}$ :  $\frac{9210}{9}$ :  $\frac{3422}{10}$ .

### 9. *Haliporus taprobanensis*, Anderson.

*Haliporus taprobanensis*, Alcock and Anderson, Ann. Mag. Nat. Hist., April 1899, p. 280.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLI. FIG. 3.

Glabrous, leathery. Rostrum straight, little ascendant, reaching to the end of the 2nd joint of the antennular peduncle, its free portion about a third the length of the rest of the carapace measured in the mid-dorsal line: its carina, which behind the cervical groove is low broad and blunt, is continued nearly to the posterior border of the carapace, being interrupted at the cervical groove and twice, broadly, behind it. The rostrum is armed dorsally with 7 or 8 nearly equidistant teeth. The cervical groove and the groove defining the branchial

region are broad and deep, and the ridge defining the branchial channel is very conspicuous along the whole length of the carapace. The spines of the carapace are well buttressed by sharp ridges.

All six abdominal terga are carinated, the first 3 broadly and incompletely, the last 3 sharply and completely so that each carina ends in a spine. The 6th abdominal somite is very little longer than the 5th. Telson "trifurcate," a little shorter than the endopodite of the caudal swimmeret.

Eyes of moderate size, their major diameter not twice that of the eyestalk. Antennular flagella very stout: in the most perfect specimen, though they are broken, the outer one is longer and the inner one much longer than the entire body.

The external maxillipeds are a good deal shorter than the 3rd pair of thoracic legs. The 4th and 5th thoracic legs are not flagelliform: the 5th pair, which are considerably longer than the 4th, are as long as the carapace (and rostrum) together with the first two abdominal terga, and are not so very much longer than the 3rd pair.

The coriaceous tubercles on which the oviducts open are very prominent, and nearly meet in the mid-sternal line. On the coxæ of the 4th pair of legs, in the female, are a pair of even larger lobules, which also nearly meet in the middle line: these together with two rounded tubercles situated, one behind the other, in the middle line of the sternum, form the "thelycum."

In the largest specimen the carapace and rostrum are 64 millim. long, the extended abdomen 105 millim. long, measured in the middle line.

Gulf of Manár 531 fathoms: off Cape Comorin between 556 and 595 fathoms.

Regd. Nos.  $\frac{3895-3806}{10}$  (Types of the species):  $\frac{1729}{10}$ :  $\frac{3854}{10}$ .

### 10. *Haliporus villosus*, Alcock.

*Haliporus villosus*, Alcock and Anderson, Journ. As. Soc. Bengal, Vol. LXIII, pt. 2, 1894, p. 146.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XXVI. FIG. 1.

Submembranous, flaccid, finely and densely hirsute. All the tissues extremely lax, the branchiæ small and very feathery.

Rostrum dorsally arched, its tip reaching nearly to the end of the 2nd joint of the antennular peduncle, armed dorsally with 6 to 8 little spines, its gastric carina distinctly continued to near the posterior border of the carapace. Cervical groove well cut, not interrupted by the rostral carina, which it distinctly notches. The sinuous longitudinal ridges that, respectively, define the branchial region and the branchial canal are very well marked, and dorsal to the former are a series of grooves and ridges that mark out several triangular and polygonal

areas on the side of the carapace. The four spines on the antero-lateral regions of the carapace are present but are very weak and flexible, and there is a fifth spinule situated on the cervical groove about midway between the true branchiostegal spine and the gastric carina.

All the abdominal terga are carinated, though those of the first two are incomplete and flaccid: the boundary between the terga and the shallow pleura is, in all the somites defined by a well marked ridge. The 6th abdominal somite is not longer than the 5th. The telson is a good deal shorter than the endopodite of the caudal swimmeret.

Eyes deficient in pigment, not very much wider than their stalk. The antennular flagella are broken, but appear to have been very long.

The external maxillipeds are a little shorter than the third pair of thoracic legs. The 4th and 5th pairs of thoracic legs are by no means filamentous, the 5th pair, which are the longest, are as long as the rostrum and carapace together with the first two abdominal terga.

The tubercles on which the oviducts open are extremely prominent, nearly meeting across the sternum: a pair of foliaceous lobules on the coxæ of the 4th pair of legs, in the female, also nearly meet across the sternum: these and two rounded eminences situated, one behind the other, in the middle line of the sternum form the "thelycum."

In the largest specimen the carapace and rostrum measure 80 millim., the extended abdomen 110 millim. in the mid-dorsal line.

Arabian Sea, in the neighbourhood of the Laccadives, 1140 and 1200 fathoms.

In the originally-printed diagnosis the epipodites have, by mistake, got shifted down a line, so that the appendages of somite VIII are shown without an epipodite and those of somite XIV with one.

Regd. Nos.  $\frac{9115}{9}$  (Type of the species):  $\frac{9116}{9}$ .

Everyone agrees that *Hymenopeneus* S. I. Smith, identical with *Haliporus*, Spence Bate; and the name *Haliporus* has the priority.

I propose to retain the name *Hymenopeneus* in a subgeneric sense, for the species in which, as in *H. taprobanensis* and *villosus*, the last two pairs of thoracic legs are not flagelliform.

### Subfamily *Aristwinæ*.

ARISTEUS, Duvernoy.

*Aristeus*, Duvernoy, Ann. Sci. Nat. Zool. (2) XV. 1841, p. 101: Wood-Mason, Ann. Mag. Nat. Hist., Oct. 1891, p. 278.

Carapace with a well developed rostrum, which is toothed dorsally only: abdomen long, with some of the somites compressed and their terga carinated.

Eyes large: eyestalks with a small tubercle on their inner face. The basal joint of the antennular peduncle is broad and triangular, and is hollowed for the reception of the eye: its outer edge is produced anteriorly into a spine, but there is no scale on its inner border.

Of the two antennular flagella the outer (upper) one is compressed sub-foliaceous and extremely short and arises near the base of the terminal joint of the peduncle, while the inner (lower) one is cylindrical and extremely long and springs from the apex of the terminal joint of the peduncle.

Antennal scale large, its outer edge strong and anteriorly acute: antennal flagellum very long.

The mandibular palp is foliaceous, but not broadly so, and of moderate length, barely reaching the antennular sternum: its terminal joint, which is more or less triangular, is much shorter than its basal joint. Palp of the first maxillæ single jointed.

The exopodite of the 2nd maxillipeds is much longer and stouter than that of the external maxillipeds the exopodite of the latter being lax and slender.

The external maxillipeds are long and pediform. The first 3 pairs of thoracic legs are chelate with the fingers long and slender, usually much longer than the palm: the last 2 pairs are slender and monodactylous.

There are usually no exopodites to the thoracic legs, but minute ones are sometimes present.

The abdominal appendages are slender, the exopodites being vastly longer than the endopodites. In the first pair no endopodite is present, but in the male there is a triangular or subtriangular "petasma" or "andricum." In the second pair the endopodite carries at its base, in the male, a pair of little scales, one behind the other. The first 3 abdominal sterna are prominent and more or less acute in the middle line.

Epipodites are present on the first 3 or 4 and podobranchiæ on the first 2 or 3 thoracic legs, and small or quite rudimentary pleurobranchiæ on most of the thoracic somites, the last pleurobranchia however (on somite XIV) being of normal size. In the subgenus *Aristæopsis* alone do the other pleurobranchiæ approximate to normal size.

The species of *Aristæus* may be grouped into five subgenera as follows:—

*Synopsis of the subgenera of Aristæus.*

I. No hepatic spine. Rostrum 3-toothed (occasionally 2-4-toothed):—

1. The third pair of thoracic legs have an epipodite but no podobranch, the 4th pair have no epipodite:—

i. Cervical groove indistinct; the pleurobranchiæ in advance of the functional one on somite xiv are mere filaments or papillæ ... .. ARISTÆUS.



- ii. Cervical groove fine but conspicuous: the pleurobranchiæ in advance of somite xiv, though small and slender, are plumose ... .. HEMIPENEUS.
2. The third pair of thoracic legs have an epipodite and a podobranch, the 4th pair have an epipodite:—
- i. Exopodite of the 2nd pair of maxillipeds stiff as in *Peneus*, much longer than the endopodite: pleurobranchiæ small and slender but plumose ... PLESIOPENEUS.
- ii. Exopodite of the 2nd pair of maxillipeds slender and lax, shorter even than the merns-joint of the endopodite: pleurobranchiæ quite large ... ARISTÆOPSIS.
- I. An hepatic spine:—
1. The third pair of thoracic legs have an epipodite, but no podobranch, the 4th pair have no epipodite ... .. HEPOMADUS.
2. The third pair of thoracic legs have an epipodite and a podobranch, the 4th pair have an epipodite: *the rostrum is many-toothed* ... .. ARISTÆOMORPHA.

### Subgenus ARISTÆUS.

*Aristæus*, Duvernoy, *loc. cit.*: Wood-Mason (part) *loc. cit.*

*Hemipeneus*, Spence Bate (part) Challenger *Crustacea Macrura*, p. 299.

Rostrum 3-toothed, very long in the female, of moderate length in the male. Cervical groove indistinct. Two spines on either side of the carapace—one behind the base of the antennule, the other behind the base of the antenna: no hepatic spine.

Last 3 abdominal terga carinated, the carina in each ending in a spine.

Terminal joint of the mandibular palp triangular. Exopodite of the 2nd pair of maxillipeds slender, subcylindrical, lax, very little longer than the endopodite. Dactyli of the last 2 pairs of legs setiform.

There is no podobranch to the 3rd pair of thoracic legs, and no epipodite to the fourth. The pleurobranchiæ of the somites from the 8th to the 13th are truly rudimentary, being either papillæ or small naked filaments, or at most small filaments with three or four tiny pinnules.

The branchial formula is as follows:—

Somites and appendages.	Podo-branchiæ.	Arthrobranchiæ.		Pleuro-branchiæ.	
		Anterior.	Posterior.		
VII	0 (ep.)	0	1 (small.)	0	= r. + ep.
VIII	1 (ep.)	0	1	r.	= 2+r. + ep.
IX	1 (ep.)	1	1	r.	= 3+r. + ep.
X	1 (ep.)	1	1	r.	= 3+r. + ep.
XI	1 (ep.)	1	1	r.	= 3+r. + ep.
XII	0 (ep.)	1	1	r.	= 2+r. + ep.
XIII	0	1	1	r.	= 2+r.
XIV	0	0	0	1	= 1
Total	4+6 ep.	5	6+r.	1+6r.	= 16+7r.+6 ep.

*Synopsis of the Indian species of the subgenus Aristæus.*

- I. Integument pubescent: the pleurobranchiæ in advance of somite  
 XIV are distinct filaments ... .. *A. virilis.*
- II. Integument glabrous: the pleurobranchiæ in advance of somite  
 XIV are reduced to mere papillæ ... .. *A. semidentatus.*

11. *Aristæus virilis*, Spence Bate.

*Hemipeneus virilis*, Spence Bate, Challenger Crustacea Macrura, p. 303, pl. xlv. fig. 4, ♂.

*Hemipeneus tomentosus*, Spence Bate, *tom. cit.*, p. 307, pl. xlix. figs. 2, 3, pl. l. ♀.

*Aristæus virilis*, Wood-Mason, Ann. Mag. Nat. Hist., Oct. 1891, p. 279.

Pubescent. Free portion of the rostrum, in the female, three-quarters of the length of the rest of the carapace measured in the mid-dorsal line, upcurved, and reaching far beyond the antennular peduncle and the antennal scale; in the male only about two-fifths the length of the rest of the carapace, nearly straight, and barely reaching the end of the 2nd point of the antennular peduncle: its carina is lost on the gastric region. The orbital (post-antennular) and post-antennal (branchiostegal) spines are small, especially the former. The cervical groove and the post-orbital crest that runs towards it are indistinct.

The 6th abdominal somite is more than half as long again as the 5th. Telson much shorter than the endopodite of the caudal swimmeret, armed on either side with 4 spinules.

Eyes globular, wider than their stalks. The outer flagellum of the antennules is from two-thirds (female) to four-fifths (male) the length of the basal joint of the peduncle, the inner flagellum is longer than the whole body: in the male alone there is a curious bend and twist of the base of the inner flagellum.

The antennal scale is very large, in the male alone its tip is curiously thickened.

External maxillipeds in the male the same length as, in the female slightly shorter than the first pair of legs: in the male alone the antero-external angle of the propodite is prolonged beyond the articulation of the dactylus, the prolongation being capped with a bunch of hairs.

The 5th pair of legs, which are the longest, reach about half a dactylus beyond the tip of the antennal scales: the 4th pair are but little shorter.

The exopodites of the 1st pair of abdominal appendages are a little more than half the entire length of the abdomen (telson excluded).

The "thelycum," when not concealed beneath a plug of coagulated secretion, consists of a nearly vertical triangular or pentagonal plate, lying between the 4th pair of thoracic legs.

The "andrium" of the 1st pair of abdominal appendages consists of a pair of sub-triangular feebly-interlocking plates, the thickened outer border of which is free and independent in its distal third.

The pleurobranchiæ in advance of somite XIV are distinct filaments some of which may bear three or four tiny pinnules.

In the largest female the carapace and rostrum are 82 millim. and the abdomen is 98 millim., measured in the mid-dorsal line. The largest males are much smaller, the measurements respectively being 50 millim. and 78 millim.

Colour in life, blood-red.

Andaman Sea, 271, 188 to 220, 405 fathoms.

Regd. Nos.  $\frac{8560}{6}$ :  $\frac{8572-8573}{6}$ :  $\frac{6674-6682}{9}$ :  $\frac{6684-6692}{9}$ :  $\frac{1410-1417}{10}$ :  $\frac{1481-1482}{10}$ .

## 12. *Aristæus semidentatus*, Spence Bate.

*Hemipeneus semidentatus*, Spence Bate, Challenger Crustacea Macrura, p. 305, pl. xlix. fig. 1, ♀.

*Aristæus semidentatus*, Wood-Mason, Ann. Mag. Nat. Hist., Oct. 1891, p. 280.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLIX. FIG. 3, ♂.

Resembles *Aristæus virilis* very closely, and differs from it only in the following characters:—

(1) the integument is glabrous and polished:

(2) the free portion of the rostrum in the female is usually longer than the carapace and is more strongly recurved; (in the male the rostrum is short and nearly horizontal, as in *A. virilis*): moreover, the carina of the rostrum is lost a little way behind the gastric region:

(3) in the male the base of the inner antennular flagellum is very slightly bent and twisted, and the antennal scale is not so greatly thickened at tip:

(4) the external maxillipeds in the male are more than a dactylus longer than, and in the female are at least as long as, the first pair of legs, though otherwise the same as in *A. virilis*:

(5) the pleurobranchiæ in advance of somite XIV are mere little papillæ, only visible with a lens.

Common in the Bay of Bengal at stations between 193 and 594 fathoms; also in the Arabian Sea near the Laccadives and Cape Comorin, between 224 and 487 fathoms.

Regd. Nos.  $\frac{4273-4276}{7}$ :  $\frac{6291-6302}{9}$ :  $\frac{6693-6701}{9}$ :  $\frac{6703-6711}{9}$ :  $\frac{9092}{9}$ :  $\frac{9094-9101}{9}$ :  $\frac{285-288}{10}$ :  $\frac{806-807}{10}$ :  
 $\frac{1949-1955}{10}$ :  $\frac{2122}{10}$ :  $\frac{3404}{10}$ :  $\frac{3803}{10}$ :  $\frac{3835}{10}$ :  $\frac{3847}{10}$ :  $\frac{3860-3863}{10}$ .

### Subgenus HEMIPENEUS.

*Hemipeneus*, Spence Bate (part), Ann. Mag. Nat. Hist., Sept. 1881, p. 186, and Challenger Crustacea Macrura, p. 299.

*Aristæus*, Wood-Mason (part), Ann. Mag. Nat. Hist. Oct. 1891, p. 278 (*A. crassipes*).

Rostrum 3-toothed (occasionally, perhaps as an abnormality, 2-4-toothed), either short in both sexes, or short in the male and very long in the female.

*Cervical groove fine but conspicuous.* An orbital and branchiostegal spine: no hepatic spine.

The last 3 or 4 abdominal terga are carinated.

The terminal joint of the mandibular palp is subtriangular and rather narrow. The exopodite of the 2nd maxillipeds is slender subcylindrical and rather lax, but is very decidedly longer than the endopodite. Dactyli of the last two pair of thoracic legs setiform.

No podobranch on the 3rd pair of thoracic legs and no epipodite on the 4th. The pleurobranchiæ in advance of somite XIV *though small and slender are plumose and functional.*

The branchial formula is as follows:—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.		Pleurobranchiæ.	
		Anterior.	Posterior.		
VII	0 (ep.)	0	1 (small)	0	= 1 (small) + ep.
VIII	1 (ep.)	0	1	1 (small)	= 2 + 1 small + ep.
IX	1 (ep.)	1	1	1 (small)	= 3 + 1 small + ep.
X	1 (ep.)	1	1	1 (small)	= 3 + 1 small + ep.
XI	1 (ep.)	1	1	1 (small)	= 3 + 1 small + ep.
XII	0 (ep.)	1	1	1 (small)	= 2 + 1 small + ep.
XIII	0	1	1	1 (small)	= 2 + 1 small
XIV	0	0	0	1	= 1
Total	4 + 6 ep.	5	6 + 1 small	1 + 6 small	= 16 + 7 small + 6 ep.

*Synopsis of the Indian species of the subgenus Hemipeneus.*

- I. Third abdominal tergum carinated in its posterior half, a large hooked spine springing from the carina ... .. *A. (H.) Carpenteri.*
- II. Third abdominal tergum non-carinate ... .. *A. (H.) crassipes.*

13. *Aristæus (Hemipeneus) Carpenteri*, Wood-Mason.

*Hemipeneus Carpenteri*, Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 189, and Oct. 1891, p. 286.  
ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLIX. FIG. 4, ♀.

Glabrous. Rostrum in the female (male unknown) much less than a third the length of the rest of the carapace in the mid-dorsal line, its tip just reaching to the end of the eyes, its carina distinct to within a short distance of the posterior border of the carapace.

The normal number of rostral teeth is three, but by damage followed by imperfect repair the number may be reduced to 2 or increased to 4.

The cervical groove is very distinct, as also is a longitudinal post-orbital ridge that runs to meet it. Very distinct also are the longitudinal ridges and grooves that traverse the branchial region.



The 3rd abdominal tergum is carinated in its posterior half, and a hooked spine springs from the anterior end of the carina: the 4th tergum is faintly, and the 5th and 6th are very sharply carinated, the carina of the last ending in a spine. The 6th abdominal somite is nearly double the length of the 5th. The telson is not two-thirds the length of the endopodite of the caudal swimmeret, and is armed on either side with 4 tiny spinules.

Eyes brown, not wider than their stalks: the tubercle of the eyestalk subacute and very prominent.

The outer antennular flagellum is about as long as the basal joint of the peduncle, the inner is very long. The antennal scale is very large, its length being nearly three-fourths that of the carapace and rostrum.

The external maxillipeds of the female are about as long as the 1st pair of thoracic legs. The first 3 pairs of legs have the meri compressed and broadened, this being most conspicuous in the 3rd pair, and the propodites not very unequal in length: the fingers in all are about twice the length of the palms. The slender 5th pair of legs reach nearly to the tips of the antennal scales, and the slender 4th pair are not much shorter.

The exopodites of the 1st pair of abdominal appendages are very long—longer than the first five and a quarter abdominal terga.

The thelycum is a prominent pentagonal plate, with the anterior angle acute, lying between the bases of the 4th pair of thoracic legs.

Colour in life, transparent orange.

In the largest female the carapace and rostrum are 32 millim., the abdomen is 60 millim., measured in the mid-dorsal line.

Arabian Sea, in the neighbourhood of the Laccadives, 902, 1022, 1091 fathoms: Bay of Bengal 1300, 1310 and 1644 fathoms.

Regd. Nos.  $\frac{7670}{6}$ :  $\frac{6039}{9}$  (Types of the species):  $\frac{528}{7}$ :  $\frac{6672}{9}$ :  $\frac{9108}{9}$ :  $\frac{3423}{10}$ .

#### 14. *Aristæus (Hemipeneus) crassipes*, Wood-Mason.

*Aristæus crassipes*, Wood-Mason, Ann. Mag. Nat. Hist., Oct. 1891, pp. 281, 282, fig. 7.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLIX, FIGS. 1, 2.

Integument covered with a very short, fine, and deciduous pubescence.

Rostrum in the female much longer than the rest of the carapace, recurved; in the male about a third the length of the rest of the carapace, ascendant, nearly straight: its carina is distinct to within a short distance of the posterior border of the carapace. (The rostrum is dorsally 3-toothed as usual). Cervical



groove very distinct: the other markings of the carapace are as in the preceding species except that the post-orbital crest is more oblique.

The 4th, 5th, and 6th abdominal terga are carinated, each carina ending in a spine: the carina of the 4th tergum is not complete anteriorly: 6th abdominal somite much more than half as long again as the 5th. Telson hardly two-thirds the length of the endopodite of the caudal swimmeret, armed on each side with 4 spinules.

Eyes black, wider than their stalk, tubercle of the stalk not very prominent. The outer antennular flagellum of the male is nearly as long as the first joint of the peduncle, but in the female is much shorter, the inner flagellum is about as long as the whole body. Antennal scale very large.

The external maxillipeds in both sexes are a good deal shorter than the first pair of legs. In the male alone they are more massive than any of the legs, the carpus is broadened, the propodite is thickened, and the dactylus, which has a spathulate tip, is twisted and curved like a sickle, with the concavity outwards.

The first 3 pairs of legs are, as in the preceding species, remarkable for the broad compressed meri (especially those of the 3rd pair) and the very long slender fingers. The slender 5th pair of legs reach beyond the antennal scale by their dactylus and half their propodite.

The exopodites of the first pair of abdominal appendages are about as long as the first four abdominal terga.

The "thelycum" is a narrow, acutely-triangular, hairy plate situated between the 4th pair of legs: in the male there is an elliptical tubercle in the same situation.

The "andricum" consists of a pair of loosely-interlocking, subtriangular plates the thickened outer edge of which is free distally.

Colour in life, crimson.

In a large female the carapace and rostrum are 95 millim. long, and the abdomen is 92 millim. long measured in the mid-dorsal line. The male is a good deal smaller.

Arabian Sea in the neighbourhood of the Laccadives and Malabar coast, 360, 406, 430, 480, 531, 595-556, 636, 767-950 fathoms. Gulf of Manár 597 fathoms. Bay of Bengal, 281, 475, 594-225 fathoms. Andaman Sea 405 and 606 fathoms.

Regd. Nos.  $\frac{6713}{9}$  (Types of the species):  $\frac{3171}{9}$ :  $\frac{9104-9107}{9}$ :  $\frac{9232-9233}{9}$ :  $\frac{298-304}{10}$ :  $\frac{1166}{10}$ :  
 $\frac{1418-1419}{10}$ :  $\frac{1956-1959}{10}$ :  $\frac{2121}{10}$ :  $\frac{2613}{10}$ :  $\frac{3405}{10}$ :  $\frac{3843-3846}{10}$ :  $\frac{3864}{10}$ .

## Subgenus PLESIOPENEUS.

*Plesiopenæus*, Bate, Ann. Mag. Nat. Hist., Sept. 1881, p. 1881: Faxon. Mem. Mus. Comp. Zool. XVIII. 1895, p. 199 (part).

*Aristæus*, Wood-Mason, loc. cit. (part: *Aristæus coruscans*).

*Aristaeopsis*, Wood-Mason, loc. cit. (part: *Aristaeopsis edwardsiana*).

Rostrum 3-toothed, either long in both sexes, or long in the female and of moderate length in the male. Cervical groove either distinct or indistinct. An orbital and branchiostegal spine: no hepatic spine.

The last 3 or 4 abdominal terga are carinated, each carina ending in a spine.

The terminal joint of the mandibular palp is triangular, sometimes with its postero-internal angle much produced. The exopodite of the 2nd maxillipeds is much longer than the endopodite and is compressed and stiffish. The dactyli of the last 2 pairs of thoracic legs are either setiform or lanceolate.

The 3rd pair of thoracic legs have a podobranch, and the 4th pair an epipodite. The pleurobranchiæ in advance of somite XIV, though much reduced in size, are plumose and functional.

The branchial formula is as follows:—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.		Pleurobranchiæ.		
		Anterior.	Posterior.			
VII	0 (ep.)	0	1 (small)	0	=	1 small + ep.
VIII	1 (ep.)	0	1	1 (small)	=	2 + 1 small + ep.
IX	1 (ep.)	1	1	1 (small)	=	3 + 1 small + ep.
X	1 (ep.)	1	1	1 (small)	=	3 + 1 small + ep.
XI	1 (ep.)	1	1	1 (small)	=	3 + 1 small + ep.
XII	1 (ep.)	1	1	1 (small)	=	3 + 1 small + ep.
XIII	0 (ep.)	1	1	1 (small)	=	2 + 1 small + ep.
XIV	0	0	0	1	=	1
Total	5 + 7 ep.	5	6 + 1 small	1 + 6 small	=	17 + 7 small + 7 ep.

*Synopsis of the Indian species of the subgenus Plesiopenæus.*

- I. Cervical groove indistinct: the carinæ of the last 4 abdominal terga end acutely: terminal joint of mandibular palp bifurcate owing to the length of the postero-internal angle: dactyli of last 2 pairs of thoracic legs lanceolate ... *A. (P.) edwardsianus*.
- II. Cervical groove distinct: only the last 3 abdominal terga are carinated: terminal joint of the mandibular palp simply triangular: dactyli of the last 2 pairs of thoracic legs setiform ... .. *A. (P.) coruscans*.

15. *Aristeus (Plesiopeneus) Edwardsianus*, Johnson.

*Peneus edwardsianus*, Johnson, P. Z. S. 1867, p. 897, ♀.

*Aristeus edwardsianus*, Miers, P. Z. S. 1878, pp. 308, 309, pl. xvii. fig. 3.

*Aristeus coralinus*, A. M. Edw., Spence Bate, Challenger Crustacea Macrura, page xxxii. fig. 10, ♂.

*Aristæopsis edwardsiana*, Wood-Mason, Ann. Mag. Nat. Hist., Oct. 1891, p. 283.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE I. FIG. 1. ♂, FIG. 2 ♀.

Glabrous, polished.

Rostrum in the female not quite as long, in the male not quite half as long as the rest of the carapace measured in the mid-dorsal line; its carina is sharp to the end of the gastric region, and then, becoming obtuse, is gradually lost in the posterior fourth of the carapace. The 2nd tooth of the rostrum stands directly above the orbital margin. Cervical groove dorsally indistinct. A very strong and sharp longitudinal ridge runs from the region of the orbit to the cervical groove. The ridge or buttress of the post-antennular tooth is very sharp, as also is that of the post-antennal (branchiostegal) tooth, the latter ridge running nearly halfway along the carapace, to the origin of the ridge that defines the branchial region. The ridge and groove that define the branchial channel are extremely well defined.

The 2nd abdominal tergum is faintly carinated; the next four terga are strongly carinated, all the carinae ending in a spine. The 6th abdominal somite is nearly twice as long as the 5th. The postero-lateral angles of the 3rd-5th abdominal pleura are mucronate. The very acute telson is shorter than the endopodite of the caudal swimmeret, its sides are armed with 4 spinules.

Eyes large, globular, wider than their stalks: the tubercle of the eyestalk small and indistinct.

The outer flagellum of the antennule is not quite as long as the basal joint of the peduncle, the inner flagellum is at least as long as the entire body.

The antennal scale in the female reaches to the end of the antennular peduncle: in the male it is produced anteriorly to form a stout fleshy flagellum the length of which is greater than that of the normal portion of the scale.

The terminal joint of the mandibular palp is bifurcate. The exopodite of the 2nd maxillipeds is rigid, compressed, and of remarkable length.

The external maxillipeds are stouter than any of the legs, the 3rd pair of which does not reach their tip. The first 2 pairs of legs are much shorter than the 3rd pair, the great difference being in the carpus: the carpus in the 1st pair is broad and very short, is slender and of medium length in the 2nd pair, and is slender clavate and very long in the 3rd pair. The 4th and 5th pairs of legs, though slenderer than any of the others, are by no means flagelliform, and have fairly stout lanceolate dactyli. The 5th pair, which are slightly the longest of all, reach to the middle of the antennal scale.

The exopodites of the 1st abdominal appendages are of extraordinary length, being longer than the first  $5\frac{1}{2}$  abdominal terga combined.

The "thelycum" is a narrow and very acute plate situated between the 4th pair of legs, and is followed by an elongate-oval tubercle situated between the 5th pair. In the male there are two spines which correspond with the 2 portions of the thelycum.

The "andricum" is a pair of loosely-interlocking, truncate-triangular plates.

In both sexes the sterna of the first 3 abdominal somites are produced, between the coxæ of their appendages, into very strong vertical uncate processes.

Colour in life, deep crimson.

In a large female the carapace and rostrum measure 112 millim., and the abdomen measures 114 millim. in the mid-dorsal line. The male grows to the same size as the female, though the rostrum is always shorter.

Arabian Sea near the Malabar coast 430 fathoms, Gulf of Manár 597 and 457-589 fathoms, Bay of Bengal 475 fathoms, Andaman Sea 188-220 and 271 fathoms.

Regd. Nos.  $\frac{8556}{6}$ :  $\frac{8558}{6}$ :  $\frac{3172}{9}$ :  $\frac{3234}{9}$ :  $\frac{6715-6716}{9}$ :  $\frac{9109-9111}{9}$ :  $\frac{9114}{9}$ :  $\frac{2120}{10}$ :  $\frac{3852}{10}$ .

## 16. *Aristæus (Plesiopeneus) coruscans*, Wood-Mason.

*Aristæus coruscans*, Wood-Mason, Ann. Mag. Nat. Hist., Oct. 1891, p. 280, fig. 6.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE II, FIG. 3.

Differs from *Aristæus (Plesiopeneus) edwardsianus* only in the following particulars:—

Rostrum in the female much longer than the carapace, its carina distinct and sharp to within a short distance of the posterior border of the carapace, its second tooth is placed far in advance of the orbital border. Cervical groove fine but very distinct. (The grooves and ridges are prominent as in the preceding species).

Only the last three abdominal terga are carinated, all the carinæ ending in a spine. The 6th abdominal somite is slightly more than twice the length of the 5th. The abdominal pleura are not mucronate at the postero-lateral angle.

The tubercle of the eyestalk is very distinct. The antennal scale reaches a good way beyond the antennular peduncle: it is not prolonged into a long fleshy flagellum in the male.

The terminal joint of the mandibular palp is subtriangular. The exopodite of the 2nd maxillipeds, though long, is not nearly twice the length of the endopo-



dite, as it is in *A. edwardsianus*. The third pair of the legs reach beyond the tip of the external maxillipeds.

The third pair of legs are not abnormally longer than the first and second, the carpus in all being an elongate joint. The fourth and fifth pair of legs have setiform dactyli, and the fifth pair reach beyond the tip of the antennal scale.

The exopodites of the 1st pair of abdominal appendages are about as long as the first  $5\frac{1}{2}$  abdominal somites.

The "thelycum" is a long, moderately acute, subpentagonal plate placed between the 4th pair of legs and followed by a transverse ridge between the fifth pair. In the male an elliptical tubercle followed by a small tooth corresponds with the "thelycum."

The andricum consists of a pair of loosely-interlocking subtriangular plates, the outer edge of which forms a free and independent process distally.

Though the first 3 abdominal sterna are, as usual, prominent and subacute in the middle line, they do not form pronounced unicate processes.

Colour in life, bright orange.

In the unique female the carapace and rostrum are 75 millim. long and the abdomen is 74 millim., measured in the mid-dorsal line. The unique male is larger, but has the rostrum broken.

Bay of Bengal, near the Andamans, 561, fathoms: Arabian Sea, between the Laccadives and the Malabar coast, 824 fathoms.

This species, as the name implies, was luminous in life, the luminous secretion coming from, or from somewhere near, the openings of the green glands.

At first sight *A. coruscans* may be confused with *A. crassipes*, but the different branchial formula, the slender meri of the first 3 pairs of legs, and, in the male, the different form of the external maxillipeds at once distinguish it.

Regd. Nos.  $\frac{6717}{9}$  (Type of the species):  $\frac{2416}{10}$ .

#### Subgenus ARISTÆOMORPHA.

*Aristeomorpha*, Wood-Mason, Ann. Mag. Nat. Hist., Oct. 1891, p. 286.

*Aristeus* (part) Spence Bate, Challenger Crustacea Macrura, p. 317 (*Aristeus rostridentatus*).

Rostrum many-toothed. *A hepatic spine*, as well as an orbital (post-antennular) and branchiostegal (post-antennal).

The last 4 abdominal terga are carinated, each carina ending in a spine.

Terminal joint of mandibular palp triangular. Exopodite of the 2nd maxillipeds stiff, compressed, very much longer than the endopodite. Dactyli of the last two pair of legs setiform.



The 3rd pair of thoracic legs have a podobranch, and the 4th pair an epipodite. The pleurobranchiæ in advance of somite XIV, though small and slender, are plumose and functional.

The branchial formula is as follows:—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.		Pleurobranchiæ.		
		Anterior.	Posterior.			
VII	0 (ep.)	0	1 (small)	0	=	1 small+ep.
VIII	1 (ep.)	0	1	1 (small)	=	2+1 small+ep.
IX	1 (ep.)	1	1	1 (small)	=	3+1 small+ep.
X	1 (ep.)	1	1	1 (small)	=	3+1 small+ep.
XI	1 (ep.)	1	1	1 (small)	=	3+1 small+ep.
XII	1 (ep.)	1	1	1 (small)	=	3+1 small+ep.
XIII	0 (ep.)	1	1	1 (small)	=	2+1 small+ep.
XIV	0	0	0	1		1
Total	5+7 ep.	5	6+1 small	1+6 small	=	17+7 small+7ep.

### 17. *Aristæus (Aristæomorpha) rostridentatus*, Sp. Bte.

*Aristæus rostridentatus*, Spence Bate, Challenger Crustacea Macrura, p. 317, pl. li. ♀.

*Aristæomorpha rostridentata*, Wood-Mason, Ann. Mag. Nat. Hist., Oct. 1891, p. 286.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA PL. II. FIG. 1.

Finely and very deciduously pubescent.

Rostrum in the female about two-thirds the length of the rest of the carapace measured in the mid-dorsal line, double-curved, markedly elevated at base, armed dorsally with 10 or 11 teeth of which the anterior 5 or 6 are small and distant; its carina is lost on the gastric region. Cervical groove indistinct. The post-orbital ridge is obtuse, but the other ridges and grooves of the carapace are very distinct.

The 6th abdominal somite is about half as long again as the 5th. The acute telson is at least as long as the endopodite of the caudal swimmeret, and is armed on either side with 4 spinules.

Eyes large, globular, wider than their stalk: tubercle on eyestalk indistinct.

The outer antennular flagellum is shorter than the first joint of the peduncle, the inner is longer than the entire body. The antennal scale reaches a little beyond the antennular peduncle.

The second joint of the mandibular palp is triangular with the postero-internal angle somewhat produced. The exopodite of the 2nd maxillipeds is of extraordinary length.

The external maxillipeds are stouter than any of the legs, the 3rd pair of legs reach to their tip. The first pair of legs are a good deal shorter than the

2nd and 3rd, having, as in *Aristæus edwardsianus*, a short and broad carpus. The slender 5th pair of legs almost reach to the tip of the antennal scale.

The exopodites of the 1st pair of abdominal appendages are a little more than half the length of the abdomen (without the telson).

The "thelycum" is a pointed plate, lying between the 4th pair of legs, and followed by a denticle, lying between the 5th pair. There is a sharp tooth in the middle line of the first 3 abdominal sterna.

In the unique female the carapace and rostrum are 73 millim. long, and the abdomen is 80 millim. long, measured in the mid-dorsal line.

Andaman Sea, 271 fathoms.

Regd. No.  $\frac{8559}{6}$ .

#### Subgenus ARISTEOPSIS.

*Aristæus* (part) Spence Bate, Challenger Crustacea Macrura, p. 312 (*A. armatus*).

*Aristeopsis* (part) Wood-Mason, Ann. Mag. Nat. Hist., Oct. 1891, p. 284 (*A. armata*).

Rostrum 3-toothed, long in both sexes. Cervical groove indistinct. An orbital (post-antennular) and a branchiostegal (post-antennal) spine. No hepatic spine.

The last 4 abdominal terga are carinated, each carina ending in a spine.

The terminal joint of the mandibular palp is triangular. *The exopodite of the 2nd maxillipeds is much shorter than the endopodite*, and is slender and lax. The dactyli of the last pair of legs are lanceolate.

The third pair of legs has a podobranch and the 4th pair an epipodite. *The pleurobranchiæ are similar in structure to the other branchiæ and are of nearly normal size.*

The branchial formula is as follows:—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.		Pleurobranchiæ.	
		Anterior.	Posterior.		
VII	0 (ep.)	0	1	0	= 1 + ep.
VIII	1 (ep.)	0	1	1	= 3 + ep.
IX	1 (ep.)	1	1	1	= 4 + ep.
X	1 (ep.)	1	1	1	= 4 + ep.
XI	1 (ep.)	1	1	1	= 4 + ep.
XII	1 (ep.)	1	1	1	= 4 + ep.
XIII	0 (ep.)	1	1	1	= 3 + ep.
XIV	0	0	0	1	= 1
Total	5 + 7 ep.	5	7	7	= 24 + 7 ep.

18. *Aristæus (Aristæopsis) armatus*, Spence Bate.

*Aristæus armatus*, Spence Bate, Ann. Mag. Nat. Hist., Sept. 1881, p. 188, and Challenger Crustacea Macrura, p. 312, pls. xlv.-xlvii.

*Aristæopsis armata*, Wood-Mason, Ann. Mag. Nat. Hist., Oct. 1891, p. 285.

Rostrum in both sexes about as long as the carapace, its carina ending on the gastric region. Cervical suture indistinguishable. All the crests of the carapace are as in *A. edwardsianus*, except that they are more obtuse.

The last 4 abdominal pleura have their postero-lateral angles mucronate. The 6th abdominal somite is half as long again as the 5th. The telson is about as long as the endopodite of the caudal swimmeret.

The eyes are hardly wider than their stalk. The outer antennular flagellum, in the male, is nearly as long as the basal joint of the peduncle, the inner flagellum is very long. The antennal scale reaches far beyond the antennular peduncle, its tip is thickened in the male.

The terminal joint of the mandibular palp is triangular with the inner edge concave. The exopodite of the 2nd maxillipeds is singularly short and slender, being very much shorter than the merus of the endopodite.

The external maxillipeds, in the male, are stouter than any of the legs, the 3rd pair of legs do not reach to their tip. The carpus of the 1st pair of legs is a much shorter and broader joint than that of the 2nd and 3rd pairs. The fifth pair of legs reach nearly to the end of the antennal scale, their dactyli are slender and pointed, but not setiform.

The exopodites of the 1st pair of abdominal appendages are about as long as the first four abdominal somites.

The andricum is a pair of feebly-interlocking sub-triangular plates, the outer edge of which is free and independent at tip.

In the male there is a semi-elliptical acuminate plate (corresponding with the "thelycum") between the 4th pair of thoracic legs, and a spine between the 5th pair. Also there is a pair of convergent spines on the coxæ of the 5th pair of legs.

The first 3 abdominal sterna, in the male, are produced, in the middle line, to form large compressed uncate processes.

Colour in life deep crimson.

In our single male the carapace and rostrum are 133 millim., and the abdomen is 145 millim. long, measured in the mid-dorsal line.

Bay of Bengal, 1748 fathoms.

Regd. No.  $\frac{6481}{9}$ .

Subgenus *HEPOMADUS*.

*Hepomadus*, Spence Bate, Ann. Mag. Nat. Hist., Sept. 1881, p. 189, and Challenger Crustacea Macrura, p. 319.

Rostrum imperfectly known, 3-toothed in one of the species and of fair length in the female. Cervical groove distinct. Three spines on either side of the carapace—an orbital, a branchiostegal (post-antemal) and a hepatic.

Terminal joint of the mandibular palp triangular. Exopodite of the 2nd maxillipeds slender, lax, much longer than the endopodite. Dactyli of the last two pair of legs very slender.

There is no podobranch to the third pair of thoracic legs, and no epipodite or only a rudimentary one, to the fourth pair. The pleurobranchiæ in advance of somite XIV, though small and slender are plumose and therefore functional.

The branchial formula is as follows:—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.		Pleurobranchiæ.		
		Anterior.	Posterior.			
VII	0 (ep.)	0	1 (small)	0	=	1 small + ep.
VIII	1 (ep.)	0	1	1 (small)	=	2 + 1 small + ep.
IX	1 (ep.)	1	1	1 (small)	=	3 + 1 small + ep.
X	1 (ep.)	1	1	1 (small)	=	3 + 1 small + ep.
XI	1 (ep.)	1	1	1 (small)	=	3 + 1 small + ep.
XII	0 (ep.)	1	1	1 (small)	=	2 + 1 small + ep.
XIII	0 (or ep. r.)	1	1	1 (small)	=	2 + 1 small
XIV	0	0	0	1	=	1
Total	4 + 6 ep.	5	6 + 1 small	1 + 6 small	=	16 + 7 small + 6 ep.

19. *Aristæus (Hepomadus) tener*? S. I. Smith.

*Hepomadus tener*, S. I. Smith, Albatross Crust., in Report U. S. Fish. Comm. for 1882, p. 409, pl. ix. figs. 7, 8, and for 1885, p. 85, pl. xix. figs. 3, 3a.

From the Bay of Bengal, 1260 fathoms, a very much damaged specimen was obtained which is probably this species.

It is characterized by the large median spine that springs from the posterior border of the 3rd abdominal tergum and projects far over the 4th tergum.

The rudimentary epipodite of the penultimate pair of legs is a tiny filament. Colour in life, bright orange.

Regd. No.  $\frac{6144}{9}$ .

## BENTHESICYMUS, Spence Bate.

*Benthescymus*, Spence Bate, Ann. Mag. Nat. Hist., Sept. 1881, p. 190, and Challenger Crustacea Macrura, p. 326; S. I. Smith, Bull. Mus. Comp. Zool. X. 1882-83, p. 81.

*Benthoecetes*, S. I. Smith, Albatross Crustacea, in Report U. S. Fish. Commission for 1882, p. 391.

Integument thin, sometimes membranous or submembranous.

Rostrum short, elevated, compressed, armed—when armed—dorsally only. Cervical groove very distinct. There is a post-antennal (branchiostegal) spine, and the orbital angle may be acute. No hepatic spine.

Eyestalks depressed and flattened, with a tubercle on their inner face: eyes often a little deficient in pigment.

The basal joint of the antennular peduncle is hollowed for the eye, and its outer edge is armed with one, or two, spines, but there is no scale on the inner edge. Both the antennular flagella are long, and the upper one, which springs from near the apex of the peduncle, is thickened in its basal part. Antennal scale very large: antennal flagellum long.

Mandibular palp foliaceous, reaching to the base of the antennules: the 2nd joint is a good deal narrower and shorter than the 1st.

Palp of the 1st maxillæ slender, single-jointed. The exopodite of the 2nd maxillipeds is very much longer than the endopodite: the endopodite is pediform, its last 3 joints are flexed on the merus, and the dactylus has some tiny spinules at tip. The exopodite of the external maxillipeds is like that of the 2nd maxillipeds but shorter: the endopodite is stout and pediform with a short dactylus that has some tiny spinules at tip.

The first 3 pairs of legs are slender subcylindrical and chelate, the fingers of the chelæ being about as long as the palm. The last 2 pairs are mono-dactylus and still more slender than the others.

The abdominal appendages are slender, the exopodites being longer than the endopodites, especially in the anterior somites: the first pair of appendages carry only an exopodite, and, in the male, a triangular "petasma" or "andricum:" in the 2nd of pair appendages, in the male, the endopodite has a pair of little scale-like lobes—one behind the other—at its base. At least the first abdominal sternum is vertically produced, or subacute, in the middle line.

Epipodites are present on the first four, and podobranchiæ on the first three, pairs of legs. Pleurobranchiæ of normal size are present on the last 7 thoracic somites.

The branchial formula is as follows:—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.		Pleurobranchiæ.	
		Anterior.	Posterior.		
VII	0 (ep.)	0	1	0	= 1+ep.
VIII	1 (ep.)	0	1	1	= 3+ep.
IX	1 (ep.)	1	1	1	= 4+ep.
X	1 (ep.)	1	1	1	= 4+ep.
XI	1 (ep.)	1	1	1	= 4+ep.
XII	1 (ep.)	1	1	1	= 4+ep.
XIII	0 (ep.)	1	1	1	= 3+ep.
XIV	0	0	0	1	= 1
Total	5+7 ep.	5	7	7	= 24+7 ep.



*Synopsis of the Indian species of Benthescymus.*

- I. Fifth abdominal tergum without a spine: rostrum 3-toothed ... *B. investigatoris*.  
 II. Carina of the 5th abdominal tergum produced to form a long  
 hooked spine: rostrum 2-toothed ... .. *B. Bartletti*.

20. *Benthescymus investigatoris*, Anderson.

*Benthescymus investigatoris*, Alcock and Anderson, Ann. Mag. Nat. Hist., April 1899, p. 282.  
 ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA PL. XII. FIG. 2.

Glabrous. Rostrum not reaching to the end of the eye, 3-toothed dorsally, produced as a sharp carina as far as the well-cut cervical groove only. A ridge defines the upper limit of the branchial region and ends, after a break, at a strong post-antennal spine, the only spine on the carapace.

The 5th and 6th and the posterior three-fourths of the 4th abdominal terga are carinated. The 6th abdominal somite is nearly twice as long as the 5th. The telson is very much shorter than the endopodite of the caudal fan.

Eyes somewhat deficient in pigment, little wider than their stalk.

Antennular flagella very long, the upper one longer than the entire body and much thickened in about its basal fifth. Antennal scale nearly twice as long as the antennular peduncle, thickened at tip in the male.

External maxillipeds stouter than any of the legs, not quite as long as the 3rd pair of legs: their dactylus is short and somewhat hooked, and ends in a pair of little spines: in the male the hooking of the dactylus is more marked than in the female, and in addition to the two terminal spines there is a little tubercle ending in a pair of spines near the base of this joint. The flagelliform 5th pair of legs reach a good way beyond the tip of the antennal scale.

The exopodites of the 1st pair of abdominal appendages are about as long as the carapace without the rostrum, between them in the middle line is an extremely prominent uncate tooth, more prominent in the male than in the female.

The "thelycum" consists of a tubercle between the 3rd pair of legs followed by two transverse bands lying respectively between the 4th and 5th pairs of legs, the first of these bands being sinuously notched anteriorly, the second being simply notched posteriorly.

The "andricum" consists of a pair of subtriangular leaves which appear to interlock only when in use.

In the type specimen the rostrum and carapace are 24 millim. long, and the abdomen is 54 millim., measured in the mid-dorsal line.

Andaman Sea, 400-200, 370-419, 498, and 640 fathoms: Gulf of Manár 597 fathoms.

Regd. Nos.  $\frac{3170}{9}$  (Types of the species):  $\frac{8517}{6}$ :  $\frac{3242}{9}$ :  $\frac{1478-80}{10}$ :  $\frac{1844}{10}$ :  $\frac{2417-2418}{10}$ .

21. *Benthesicymus Bartletti*, S. I. Smith.

*Benthesicymus Bartletti*, S. I. Smith, Bull. Mus. Comp. Zool. X. 1881-82, p. 82, pl. xiv. figs. 1-7.

*Benthoecetes Bartletti*, S. I. Smith, Albatross Crust. in Rep. U. S. Fish. Comm. for 1882, p. 391, pl. x. fig. 8, and for 1885, p. 87, pl. xviii. figs. 2, a-b, and Proc. U. S. Nat. Mus. 1885, p. 508: A. Agassiz, Bull. Mus. Comp. Zool. XV. 1888, p. 47, fig. 248.

So far as the male is concerned this species closely resembles *B. investigatoris*, from which it differs only in the following particulars:—

(1) the rostrum has only 2 teeth on its dorsal edge:

(2) only the 5th and 6th abdominal terga are carinated, and the carina of the 5th is armed with a long hooked spine:

(3) the curved and truncated dactylus of the external maxillipeds has several spines, which are placed at its tip and along its outer edge:

(4) the vertical tooth on the 1st abdominal sternum is even larger.

Bay of Bengal, off the north-eastern coast of Ceylon, 771-665 fathoms.

Regd. No.  $\frac{3857}{10}$ .

## GENNADAS, Spence Bate.

*Gennadas*, Spence Bate, Ann. Mag. Nat. Hist., Sept. 1881, p. 191: Challenger Crustacea Macrura, p. 339.

*Amalopenæus*, S. I. Smith, Bull. Mus. Comp. Zool. X. 1881-82, p. 86.

Differs from *Benthesicymus* only in the following particulars:—

(1) the exopodites of the 2nd maxillipeds are only about as long as the endopodites, and the endopodites have a thin broad foliaceous oval merus beneath which the 3 terminal joints are concealed in flexion:

(2) the ischium and merus of the external maxillipeds are also thin broad and subfoliaceous:

(3) the ischium merus and carpus of the 1st pair of legs are thin broad and compressed:

(4) the pleurobranchiæ though by no means rudimentary are considerably reduced in size.

It is doubtful whether it would not be better to regard *Gennadas* as a subgenus of *Benthesicymus*.

*Synopsis of the Indian species of Gennadas.*

- |     |  |        |                      |
|-----|--|--------|----------------------|
| I.  | The 3rd-6th abdominal terga are carinated: the exopodites of the 1st pair of abdominal appendages are longer than the carapace (and rostrum) | ... .. | <i>G. carinatus.</i> |
| II. | Only the 6th abdominal tergum is carinated: the exopodites of the 1st pair of abdominal appendages are shorter than the carapace.            | ... .. | <i>G. parvus.</i>    |

22. *Gennadas carinatus*, (S. I. Smith).

*Benthescymus ? carinatus*, S. I. Smith, Albatross Crust., in Rep. U. S. Fish. Comm. for 1882, p. 396, pl. x. figs. 6-7 : Alcock and Anderson, Journ. As. Soc. Bengal, part 2, Vol. LXIII. 1894, p. 147.

Integument membranous, flaccid.

Rostrum not reaching to the end of the eye-stalk, unarmed, continued as a sharp carina to the well-cut cervical groove. The longitudinal ridge that bounds the branchial region superiorly runs, with a break at the cervical groove, into a weak post-antennal spine. The suborbital angle is sharp, and behind it there is a longitudinal crest. The hepatic region is defined by a ridge.

The abdominal terga from the 3rd to the 6th, both included, are carinated. The 6th abdominal somite is a little more than twice the length of the 5th. Telson as long as the endopodite of the caudal fan, armed on either side at the far end with 4 spines.

Eyes not much broader than the stalk: tubercle of the eyestalk acute. Antennular flagella broken, the upper flagellum is thickened at base. Antennal scale about a third as long again as the antennular peduncle.

The dactylus of the external maxillipeds though broad at base ends acutely, and has some tiny spinules along its convex border.

Abdominal appendages lax and feathery, the exopodites of the 1st pair are longer than the carapace and rostrum: between the bases of the 1st pair is, in the male at least, a sternal tubercle.

The "andricum" consists of a pair of simple leaves which are not in contact when not in use.

In the only Indian specimen the carapace and rostrum are 51 millim. long, and the abdomen is 84 millim. measured in the mid-dorsal line.

Arabian Sea, near the Laccadive Islands, 902 fathoms.

Regd. No.  $\frac{917}{9}$ .

23. *Gennadas parvus*, Spence Bate.

*Gennadas parvus*, Spence Bate, Ann. Mag. Nat. Hist., Sept. 1881, p. 192, and Challenger Crustacea Macrura, p. 340, pl. lix : Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 189 and Oct. 1891, p. 286.

Submembranous, glabrous.

Rostrum very short, not reaching nearly halfway along the eyestalk, armed dorsally with a single tooth, its carina is very distinct as far as the well-cut cervical groove, behind which it is traceable as a faint ridge nearly to the posterior border of the carapace. A weak post-antennal tooth is the only armature of the carapace.

The 6th abdominal tergum alone is carinate: the 6th abdominal somite is twice as long as the 5th. The telson is not much more than half the length of the endopodite of the caudal swimmeret.

Eyes deficient in pigment, not broader than the stalk, having a speck of black pigment near their base: the tubercle of the eyestalk is acute and very large.

The antennular flagella are long, the upper one is thickened at base. The antennal scale barely surpasses the antennular peduncle.

The dactylus of the external maxillipeds is short and broad and compressed, being narrowest at its basal end.

The exopodites of the 1st abdominal appendages are not as long as the carapace: between the bases of the 1st abdominal appendages is an acute tubercle, most prominent in the male.

The "thelycum" consists of a horizontal subtriangular plate or tubercle, placed between the 3rd pair of legs, followed by two transverse bars between the 4th and 5th pairs. The first of these bars is somewhat **W**-shaped, with the posterior notch of the **W** filled by a tooth in the middle of the anterior border of the 2nd bar.

The "andricum" consists of a pair of large leaves which are a good deal pleated longitudinally and a good deal fimbriated distally.

Colour in life deep crimson.

In one of our larger specimens the carapace and rostrum are 10 millim. long, and the abdomen is 25 millim., measured in the mid-dorsal line.

Bay of Bengal, 764, 922, 1260 fathoms: Arabian Sea, near and north of the Laccadives 738, 764, 865-880, 891, 931 and 1043 fathoms.

Regd. Nos.  $\frac{530-531}{7}$  :  $\frac{538}{7}$  :  $\frac{6142-6143}{9}$  :  $\frac{6477}{9}$  :  $\frac{9208}{9}$  :  $\frac{311}{10}$  :  $\frac{371}{10}$  :  $\frac{526}{19}$  :  $\frac{531}{10}$ .

### Family *Sergestidae*, Dana.

Dana, U. S. Expl. Exped. Crust. pt. I, p. 601: Spence Bate, Challenger Crust. Macrura, p. 345: Stebbing, Hist. Crust., p. 221: Ortmann in Bronn's Thier Reich, Arthropoda, p. 1121: HANSEN, P. Z. S. 1896.

Rostrum very small or absent: ophthalmic somite usually much exposed.

Epipodite of 2nd maxillipeds small. Exopodites are absent from all the thoracic appendages behind the 1st maxillipeds.

The first pair of legs are non-chelate: the 4th and 5th pair are short, with the number of segments reduced—sometimes they are rudimentary or altogether wanting.

Branchiæ few—never more than 8 on either side—sometimes wanting altogether.



## SERGESTES, Edw.

*Sergestes*, Milne Edwards, Ann. Sci. Nat., Zool., (2) XIX. 1830, p. 346, and Hist. Nat. Crust. II. 427: Spence Bate, Challenger Crustacea Macrura, p. 350: Hansen, P. Z. S. 1896, p. 936.

Integument thin. Carapace with a very short rostrum. Abdomen long with some of the somites compressed, ending in a tail-fan of which all the segments are comparatively slender.

Eyes in the adult of moderate size, the ophthalmic somite exposed. The antennules have a long peduncle, the basal joint of which has no scale on its inner edge, and they support two flagella of which one is very long and the other very short, the short one in the male bifurcating to form a prehensile apparatus.

Antennal scale large: antennal flagellum long.

The mandibular palp is thin and narrowly-foliaceous, and is of great length. The palp of the 1st maxillæ is short.

The last 2 pairs of maxillipeds, like the thoracic legs, have no exopodites. The 2nd maxillipeds are pediform, stout, and generally have the 3 terminal joints permanently flexed. The external maxillipeds quite resemble the anterior three pairs of legs, and are of great length. The legs usually increase in length from the 1st to the 3rd pairs, the 2nd and 3rd pairs being microscopically chelate. The 4th and 5th pairs of legs are reduced in size and in the number of their segments, the 5th pair sometimes being very short: both of them are monodactylus.

The abdominal appendages, except those of the first pair, are biramous, both rami being slender, and the exopodite much longer than the endopodite. The first pair, in the male, carry a prehensile "andricum," and the 2nd pair, at the base of the endopodite, a small lobule.

The functional branchiæ are 7 or 8 on each side: all of them except the first—which is a podobranch borne on the 2nd maxillipeds—are pleurobranchiæ.

*Synopsis of the species of Sergestes of the Indian Neeton.*

- I. External maxillipeds not longer than the 3rd pair of thoracic legs:—
1. 2nd and 3rd joints of the antennular peduncle stout: no hepatic spine:—
    - i. Two grooves across the dorsum of the carapace, one gastro-hepatic the other cervical ... .. *S. bisulcatus.*
    - ii. only a gastro-hepatic, no true cervical groove ... .. *S. inous.*
  2. 2nd and 3rd joints of the antennular peduncle slender: a minute hepatic spine ... .. *S. rubroguttatus.*
- II. External maxillipeds twice as long as the 3rd pair of thoracic legs: a hepatic and a postocular spine (both very small) ... .. *S. hamifer.*



24. *Sergestes bisulcatus*, Wood-Mason.

*Sergestes bisulcatus*, Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 190 and Nov. 1891, p. 353; Faxon, Mem. Mus. Comp. Zool. XVIII, 1895, p. 210; Hansen, P. Z. S. 1896, p. 949.

*Sergestes phorcus*, Faxon, Bull. Mus. Comp. Zool. XXIV, 1893, p. 217 (*ipso teste*).

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE L, FIGS. 1, 1a-b.

Rostrum strongly ascendant, acute, not nearly reaching halfway along the ophthalmic somite, its anterior margin a little convex near the middle. The fine gastro-hepatic groove is just traceable across the dorsum of the carapace, behind it the true cervical groove is very distinct dorsally. No postocular or hepatic spines.

The outer edge of the exopodite of the caudal swimmeret is setose in little more than its distal fourth.

Eyestalks not half as long as the basal joint of the antennular peduncle: eye large, black, a good deal wider than its stalk.

Antennular peduncle extremely robust in all its joints, about three-fourths the length of the carapace measured in the mid-dorsal line, nearly half its length being contributed by the basal joint: of the other two joints the 2nd is a very little longer than the 3rd. The basal joint is hollowed for the eyes. The inner (upper) antennular flagellum is at least as long as the entire body; the short and slender outer flagellum, in the male, has the usual accessory prehensile flagellum.

Antennal scale a little more than half the length of the carapace measured in the mid-dorsal line, its tip is rounded and its outer edge ends in a spine: the flagellum is several times longer than the body.

The 2nd maxillipeds are the stoutest of all the thoracic appendages: the external maxillipeds are considerably shorter than the 3rd pair of legs and reach beyond the end of the antennular peduncle: their 3 terminal joints are setose on both edges.

The 3rd pair of legs, which are the longest, reach beyond the tip of the antennular peduncle; their microscopic chelæ, like those of the 2nd pair of legs, are hidden in a tuft of fine setæ; and their two terminal long-joints, like the three terminal joints of the 1st and 2nd pair of legs, are setose on both edges. The 4th pair of legs are considerably longer than the carapace: all their four long joints are very thin and broad and have the posterior border closely and very regularly fringed with setæ of extraordinary length, while similar shorter (but still very long) setæ fringe the anterior border also of the first two of them. The 5th pair, which are a little more than half the length of the 4th, resemble the 4th in every respect, except that the constituent joints are not so broad.

Each half of the "andricum" is deeply cleft into 3 lobes (1) an inner membranous portion that interlocks with its fellow of the opposite side, to form

a channel, (2) an outer short and rigid style with a broadly laminar base and with a little hook on the outer edge of its truncated tip, and (3) a long median rod which branches distally into six more or less distinctly prehensile stiff filaments.

There are 8 gills on either side: the 1st is a podobranch attached to the external maxillipeds, the next 3 are pleurobranches, attached one each to somites IX-XI, the next 4 are pleurobranches attached two each to somites XII and XIII.

In the largest specimen the carapace is 19.5 millim. long, the abdomen 43 millim., measured in the mid-dorsal line.

Colours in life: blood-red, eyes black.

Common in the Bay of Bengal, 145 to 840 fathoms, in the Arabian Sea, 364 to 902 fathoms, and Andaman Sea, 265 to 419 fathoms.

The species seems to me to be doubtfully distinct from *S. robustus* S. I. Smith.

Regd. Nos.  $\frac{6069-6070}{9}$  (Types of the species):  $\frac{539}{7}$  :  $\frac{542}{7}$  :  $\frac{4790-4792}{7}$  :  $\frac{3115}{9}$  :  $\frac{6269-6270}{9}$  :  $\frac{9202-9203}{9}$  :  $\frac{9207}{9}$  :  $\frac{9211}{9}$  :  $\frac{313}{10}$  :  $\frac{812}{10}$  :  $\frac{2586-2587}{10}$  :  $\frac{3407}{10}$  :  $\frac{3420}{10}$  :  $\frac{3865}{10}$ .

## 25. *Sergestes* sp. ? *inous*, Faxon.

*Sergestes mollis*, Wood-Mason, Ann. Mag. Nat. Hist. (6) VIII, 1891, p. 353.

? *Sergestes inous*, Faxon, Bull. Mus. Comp., Zool., XXIV, 1893, p. 216, and Mem. Mus. Comp. Zool., XVIII, 1895, p. 208, pl. li, fig. 2.

Integument membranous: tissues flaccid.

Rostrum ascendant, blunt, very short. Gastro-hepatic groove distinct. No spines on the carapace.

Outer border of the exopodite of the tail-fan setose only in its distal fourth, beyond a microscopic denticle.

Eyestalks two-thirds the length of the basal joint of the antennular peduncle, "smeared with black pigment," eyes black, little wider than their stalk.

Antennular peduncle robust in all its joints, a little more than half the length of the carapace measured in the mid-dorsal line, its 1st segment being slightly the longest of the three and being hollowed for the eye: the lower (outer) flagellum, in the male, has the usual accessory prehensile flagellum.

Antennal scale barely half the length of the carapace measured in the mid-dorsal line: its tip is broadly rounded, and its outer edge, which is hardly thickened, ends in a microscopic spinule.

The first 3 pairs of legs resemble those of *S. bisulcatus*, but are far more slender. The 4th pair also resemble those of *S. bisulcatus*, but their joints are not so broad.

The "andricum" is of the same general character as that of *S. bisulcatus*: the most noticeable difference is, that one of the hooklets into which the middle lobe splits up has a foliaceous base.

(The external maxillipeds and 5th pair of legs are missing in the only specimen).

The branchial formula is as follows:—

Somites and Appendages.	Podobranchiæ.	Pleurobranchiæ.
VII	(ep.)	= ep.
VIII	1 (ep.)	r. = 1+r.+ep.
IX	0	1+r. = 1+r.
X	0	1+r. = 1+r.
XI	0	1+r. = 1+r.
XII	0	2 = 2
XIII	0	2 = 2
XIV	0	0 = 0
<hr/>		
Total	1+2 ep.	7+4 r. = 8+4 r.+2 ep.

Colour in life, lurid red.

The carapace is 30 millim. long, the abdomen 60 millim. in the mid-dorsal line.

Arabian Sea, 1091 fathoms.

Regd. No.  $\frac{527}{7}$ .

Though very similar to it, this species is not identical with *S. mollis* S. I. Smith, as I have ascertained by comparison with one of the duplicates from the U. S. National Museum.

It differs from *S. mollis*, as Faxon has pointed out, in that the posterior pleurobranch of somite XII is a functional gill-plume instead of a rudimentary filament.

## 26. *Sergestes rubroguttatus*, Wood-Mason.

*Sergestes rubroguttatus*, Wood-Mason, Ann. Mag. Nat. Hist., Nov. 1891, pp. 354, 355, fig. 10: Hansen, P. Z. S. 1896, pp. 949, 955.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLI. FIG. 5.

Rostrum strongly ascendant, subacute, arising from a well defined areola of its own, only just overhanging the anterior border of the carapace.

Gastro-hepatic groove very distinct in all its course. The cervical groove not visible on the dorsum of the carapace. A very strong longitudinal ridge runs from the antennal margin halfway along the carapace, where it meets two equally strong ridges, one of which curves upwards and defines the branchial

region dorsally, while the other curves downwards and is lost on the lower part of the branchial region. There is a minute hepatic spine.

The outer edge of the exopodite of the tail-fan is setose in less than its distal half.

Eyestalks a little over half the length of the basal joint of the antennular peduncle: eyes black, wider than the rather slender stalks.

Antennular peduncle, more than three-fourths the length of the carapace measured in the middle line, the basal joint, which is longer than the second joint, but little if at all longer than the third, is hollowed for the eye, and is thin, except along the inner edge: the next two joints are slender and cylindrical: the upper flagellum long, the short lower flagellum in the male has the usual prehensile accessory filament.

Antennal scale nearly two-thirds the length of the carapace, extremely thin: its tip is rounded and its outer edge ends in a microscopic spinule.

The 2nd maxillipeds, though stout, are not as stout as the proximal long joints of the external maxillipeds. These latter are rather stouter, in respect of their first three long joints, than the legs, and are only just shorter than the 3rd pair of legs: the tip of their third long joint coincides with the tip of the antennular peduncle: they, like the legs, are setose on both edges.

The 1st pair of legs are a good deal shorter than the 2nd, the 2nd are little shorter than the 3rd: the microscopic chelæ of the 2nd and 3rd pairs are hidden in tufts of setæ. The 4th pair of legs are longer than the carapace, all their four long-joints though slender are much compressed and have their posterior border closely fringed with silky setæ of extraordinary length. The 5th pair of legs, which are less than half the length of the 4th, resemble the latter, but are more slender.

The "andricum" is much like that of *S. bisulcatus* but the prehensile filaments in which the middle lobe ends are more deeply cleft.

Colours in life, transparent white with many pink blotches.

The branchiæ are 8 on either side, namely, a podobranch on the 2nd maxillipeds, a pleurobranch on each of somites IX to XI, and 2 pleurobranchiæ on each of somites XII and XIII.

In the largest specimen the carapace is 18 millim., the abdomen 35 millim., measured in the mid-dorsal line.

Arabian Sea, 738 fathoms, Bay of Bengal, 764, 922, 1748, 1997 fathoms, Andaman Sea, 498 fathoms.

Regd. Nos.  $\frac{534-535}{7}$ :  $\frac{544}{7}$  (Types of the species):  $\frac{6071}{9}$ :  $\frac{6670-6671}{9}$ :  $\frac{527-530}{10}$ :  $\frac{2421}{10}$ .



27. *Sergestes hamifer*, Alcock and Anderson.

*Sergestes hamifer*, Alcock and Anderson, Journ. Asiatic Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 148: Hansen, P. Z. S., 1896, pp. 951, 963.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE IX. FIG. 3.

Rostrum slightly ascendant, acutely pointed, reaching nearly halfway along the eyestalk. A minute post-ocular and an even more minute hepatic spine are present. Cervical groove fine, but distinct. The other markings of the carapace as in *S. rubroguttatus*.

The outer border of the exopodite of the caudal fan has neither spine nor setæ.

Eyestalks about two-thirds the length of the basal joint of the antennular peduncle: eyes black, not wider than their stalk.

Antennular peduncle about two-thirds the length of the carapace, measured in the middle line: the elongate-triangular basal joint is hollowed for the eye and is about as long as the slender cylindrical 2nd joint: the 3rd joint is decidedly the longest and slenderest of all. The outer (upper) flagellum is as long as the body, the inner flagellum in the female is shorter than the eyestalk.

Antennal scale slender and acute, more than half the length of the carapace, its edges are setose.

The 2nd maxillipeds are very stout. The external maxillipeds are far stouter than the legs and are far the longest of all the appendages, being longer than the entire body and twice as long as the 3rd pair of legs: they are quite devoid of setæ, but their penultimate joint, which is curved and is much broadened and compressed in its distal moiety, is armed along the posterior border of that moiety with a series of acicles, as is also the posterior border of the terminal joint: the terminal joint is divided into 4 segments and ends in a spine which is articulated to the last sub-segment.

The legs are very slender and short: they are without setæ, but in the first pair the posterior border of the 3rd and terminal joints have a row of fine short tooth-like bristles. The 1st pair are about half the length of the carapace; the 3rd pair, which are the longest, are as long as the carapace and first abdominal somite. The 4th pair are about three-fourths the length of the carapace and have the three terminal joints thin and compressed. The 5th pair, which are very slender, are not half the length of the carapace.

The branchiæ are 8 on either side, namely, a podobranch on the external maxillipeds, a pleurobranch on somites IX–XI, and two pleurobranchiæ—the upper one of which is reduced in size—on each of somites XII and XIII.

Arabian Sea, in the neighbourhood of the Laccadives, 1370 fathoms.

Regd. No.  $\frac{9216}{9}$  (Type of the species).



## CARIDEA, Dana.

- Caridea*, Dana, U. S. Expl. Exp., Crust., pt. I. p. 528 : Stebbing, Hist. Crust., p. 224.  
*Eucyphotes*, Boas, Vid. Selsk. Skr., 6 Raekke, nat. math. Afd. I. 2. 1880, p. 156.  
*Phyllobranchiata Normalia*, Spence Bate, Challenger Crust. Macrura, p. 480.  
*Eucyphidea*, Ortmann, in Bronn's Thier Reich, Arthropoda, p. 1122.

The pleura of the 1st abdominal somite are overlapped by those of the 2nd.

The mandible is often, but by no means always, deeply cleft into incisor and molar branches: the endopodite (palp) when present is only exceptionally expanded and foliaceous.

The coxopodite of the 2nd maxillæ is usually small and receding (occasionally obsolete), and is never cleft into two lobes.

The endopodite of the 1st maxillipeds is short.

In the 2nd maxillipeds the last joint rarely articulates end-on with the distal end of the propodite, though it does so sometimes: it usually lies along the inner edge of the propodite, as if it were a complementary piece of the latter joint.

The external maxillipeds are 4- or 5-jointed, the dactylus and propodite being fused together to form the terminal joint, and the ischium and merus, or the basis ischium and merus, being fused to form the 3rd or the 2nd joint.

The first two pairs of legs may be chelate or subchelate, but the 3rd pair are always monodactylous.

An internal appendix, usually armed with hooklets, is almost always present on the base of the endopodite of the abdominal appendages from the 2nd to the 5th.

The branchiæ are phyllobranchiæ.

The ova when laid are attached to the abdominal appendages of the female.

The *Caridea* of the Indian Benthos and Necton fall into nine families, but before indicating the inter-relations of these families I wish, for the convenience of students, to insert the following artificial key for their discrimination.

*Key to the families of Indian Deep-Sea Caridea.*

- I. No exopodites to the thoracic legs (except in certain species of *Crangonidæ* where the 1st pair has a small exopodite) :—
  1. Carpus of second pair of thoracic legs unsegmented, simple :—
    - i. Second pair of thoracic legs chelate and very pre-eminently robust ... .. PALEMONIDÆ.
    - ii. Second pair of legs slender :—
      - a. First pair of thoracic legs subchelate ... CRANGONIDÆ.
      - b. First pair of legs with forcipulate chelæ ... PSALIDPOPIDÆ.

2. Carpus of second pair of thoracic legs subdivided into 2 or many segments:—
- i. First pair of thoracic legs very robustly chelate, of unequal size ... .. ALPHEIDÆ.
  - ii. First pair of legs robust, subchelate ... .. GLYPHOCRANGONIDÆ.
  - iii. First pair of legs slender, apparently monodactylous ... .. PANDALIDÆ.
- II. The thoracic legs, or at least the first four pairs, have exopodites: carpus of the second pair unsegmented, simple:—
1. The thoracic legs are slender, and of enormous length, the first four pairs have small exopodites ... .. NEMATOCARCINIDÆ.
  2. The thoracic legs are of no extraordinary length, all five pairs have large exopodites:—
    - i. The exopodites of the 2nd maxillipeds are large ... HOPLOPHORIDÆ.
    - ii. The exopodites of the 2nd maxillipeds are rudimentary or absent ... .. PASIPHÆIDÆ.

The following table is meant to illustrate my own views as to the natural inter-relations of the *Caridea* of the Indian Neeton and Benthos.

Alliance I. PASIPHÆOIDA. Mandibles with a simple serrated edge, with or without palp. Exopodites of 1st maxillipeds with a broad foliaceous flagellum. The last segment of the 2nd maxillipeds is a typical dactylus articulating end-on with the propodite, as in *Peneus*. All the thoracic legs have large exopodites, but the exopodites of the 2nd maxillipeds are rudimentary or absent. The first two pairs of thoracic legs are the longest and stoutest and end in elongate well-formed chelæ, the 2nd pair having a simple carpus.

This alliance includes the genera that constitute the single family *Pasiphæidæ*. Of these genera the only one that might perhaps be separated to form a distinct family within the alliance is *Psathyrocaris*.

Alliance II. HOPLOPHOROIDA, including the single family *Hoplophoridæ*. Mandibles with incisor and molar processes distinct but almost confluent; with a stout incurved palp. The last segment of the 2nd maxillipeds may (*Ephyrina*) be an almost typical dactylus, but usually it lies obliquely along the distal part of the inner border of the propodite as if it were a complementary piece of that joint. The exopodites of the 1st maxillipeds have the form of a simple falcate leaf without a flagellum. All eight pairs of thoracic appendages have well developed exopodites. The first two pairs of thoracic legs end in slender well formed chelæ, the 2nd pair having a simple carpus.

In this alliance *Ephyrina* marks the point of connexion with the *Pasiphæidæ*.

Alliance III. PANDALOIDA, including the two families *Pandalidæ* and *Nematocarcinidæ*. Mandibles deeply cleft into two well formed well calcified branches—an incisor and a molar—and having a stout incurved palp. The

exopodites of the 1st maxillipeds end in a slender flagellum. The last segment of the 2nd maxillipeds lies obliquely along the distal part of the inner border of the propodite as if it were a complementary piece of that joint. The first two pairs of thoracic legs are slender.

Family i. *Pandalida*. None of the thoracic legs have exopodites; the 1st pair are microscopically and very imperfectly chelate (apparently monodactylous); the 2nd pair are minutely chelate and have a carpus compounded of two or many segments.

Family ii. *Nemotocareinida*. All the thoracic legs except the last have small exopodites; the first two pairs are finely chelate and the carpus of the 2nd pair is simple.

Alliance IV. PSALIDOPODOIDA, including the single genus *Psalidopus*, which on the one hand is nearly related to the *Glyphocrangonida* and *Crangonida* and on the other hand to the *Hopliphorida*. Mandibles cleft into incisor and molar branches, but the incisor branch is flexible and imperfectly calcified; mandibular palp stout, incurved. The exopodites of the 1st maxillipeds have the form of a simple falcate leaf, without flagellum. The last segment of the 2nd maxillipeds is "complemental" of the propodite, as in the *Pandaloida*. None of the thoracic legs have exopodites: the first pair end in forcifolate chelæ—both fingers being movable, the 2nd pair have a simple carpus and the dactylus replaced by a pencil of setæ.

Alliance V. CRANGONIDA. Mandibles not deeply cleft into incisor and molar branches, and having no palp. The exopodites of the 1st maxillipeds end in a slender flagellum. The last segment of the 2nd maxillipeds is "complemental" of the propodite as in *Pandaloida*. Except in a few species of *Crangonida* in which an exopodite is present on the 1st pair of thoracic legs, exopodites are absent from the thoracic legs. First pair of thoracic legs stout, subchelate.

Family i. *Crangonida*. The 2nd pair of thoracic legs, when present, have a simple carpus.

Family ii. *Glyphocrangonida*. The 2nd pair of thoracic legs have a carpus compounded of many segments.

Alliance VI. PALEMONIDA. Mandibles deeply cleft into well calcified incisor and molar branches, and usually having a stout incurved palp. The exopodites of the 1st maxillipeds end in a flagellum. The dactylus of the 2nd maxillipeds is "complemental" of the propodite, as in *Pandaloida*, *Crangonoida*, etc. None of the thoracic legs have exopodites: of the first two pairs one is remarkably massive, both being chelate.

Family i. *Palaemonida*. The 2nd pair of thoracic legs is robustly chelate, one being often larger than the other, and has a simple carpus.

Family ii. *Alpheidæ*. The 1st pair of thoracic legs is robustly chelate, one being larger than the other: the 2nd pair has a carpus compounded of many segments.

### Family *Pasiphæidæ* Smith, Bate.

*Pasiphæidæ*, S. I. Smith, Albatross Crustacea in Rep. U. S. Fish. Comm. for 1882 (1884), p. 381.

*Pasiphæidæ*, Spence Bate, Challenger Crust. Macrura, p. 857: Stebbing, Hist. Crust., p. 251: Ortman, in Bronn's Thier Reich, p. 1125, Arthropoda.

Rostrum short, sometimes represented by a spine or tooth arising behind the frontal margin. Antennular scale large. Antennal scale with a broadish tendency.

Mandible with a single serrated edge, not cleft into two distinct processes: mandibular palp present or absent.

The coxa and basis of the 1st maxillæ are always well developed, but those of the 2nd maxillæ and 1st maxillipeds are sometimes small or rudimentary, sometimes obsolete, and only in one genus (*Psathyrocaris*) are perfectly normal.

The terminal joint of the 2nd maxillipeds is a distinct dactylus articulating with the distal end of the propodite. The external maxillipeds are long and pediform.

Exopodites, which often are very long, are present on all the thoracic legs: they are also present—though sometimes they are very small—on the external maxillipeds; they are rarely present—and then are very small—on the 2nd maxillipeds; but they often constitute the chief part of the 1st maxillipeds.

The first two pairs of thoracic legs are the longest and much the stoutest: they end in elongate chelæ with long slender fingers: the carpus of the 2nd pair, like that of the 1st, is short and unsegmented. The last three pairs of thoracic legs are always slender, and the penultimate pair is usually short, as sometimes is the last pair also.

The eggs are usually large.

#### *Synopsis of the genera of Pasiphæidæ of the Indian Necton.*

- I. The abdominal appendages are of the ordinary kind: the 4th pair of thoracic legs are always very short: the 2nd maxillæ consist chiefly of scaphognathite, the coxa and basis being small or obsolete and the endopodite being abnormally small: the 1st maxillipeds consist chiefly of exopodite, the coxa and basis and endopodite being rudimentary or obsolete though the epipodite may be distinct and independent: the 2nd maxillipeds have no gill-plume:—

1. Body strongly compressed: the rostrum is usually a post-frontal spine or tooth: the mandibles have no palp: the coxa and basis of the 2nd maxillæ and 1st maxillipeds are obsolete, the latter appendages consisting almost entirely of exopodite: the 5th pair of thoracic legs is about twice as long as the 4th

... PASIPHÆA.



2. The rostrum is a normal prolongation of the end of the carapace: mandibles with a slender palp: coxa and basis of 2nd maxillæ small but recognizable: in the 1st maxillipeds the epipodite is independent, and the endopodite though extremely small is distinct:—
- i. Body compressed: 5th pair of {thoracic legs no longer than the 4th: no epipodite on the 2nd maxillipeds ... SYMPASIPHÆA.
  - ii. Body moderately compressed: 5th pair of legs {decidedly longer than the 4th: 2nd maxillipeds with an epipodite ... .. PARAPASIPHÆA.
- II. The abdominal appendages are filiform, the endopodites being very short and the exopodites being of extraordinary length: the 4th pair of thoracic legs are not much reduced in length: the mandibles have a large foliaceous palp: the 2nd maxillæ and 1st maxillipeds are perfectly normal in all their parts: the 2nd maxillipeds carry an epipodite and a gill-plume ... .. PSATHYROCARIS.

### PASIPHÆA, Savigny.

*Pasiphæa*, Savigny, Mem. sur. les Anim. sans vertébrés, p. 50, note: Milne Edwards, Hist. Nat. Crust. II. 424: Spence Bate, Challenger Crust. Macrura, p. 863.

Body strongly compressed. Rostrum a short obliquely-ascendant post-frontal spine or crest. Carapace short: the orbital and post-antennular angles are defined but blunt, and the only spine is one situated immediately behind the antenna.

Abdominal pleura deep and wide: telson acute: the outer plate of the tail-fan with a fine transverse suture.

Eyes of fair size, placed obliquely and somewhat ventrally on the eye-stalks. Antennular peduncle of fair length and supporting two longish flagella, the outer of which is thickened at base: the antennular scale is of fair length.

The mandibles consist simply of a serrated incisor process, without molar process or palp.

The 1st maxillæ have the coxa, basis and palp well-developed, the inner edge of the basis being spinose.

The 2nd maxillæ consist of a large scaphognathite and a short and slender endopodite, the coxa and basis being undistinguishable.

The 1st maxillipeds consist simply of a membranous leaf, the representative of the exopodite: its outer proximal angle, which is produced, represents the epipodite, and a papilla in the distal half of the inner border represents the endopodite, but no trace of an independent coxa or basis is discoverable.

The 2nd maxillipeds consist of a seven-jointed endopodite, without exopodite or epipodite: the terminal joint is a distinct dactylus.



The external maxillipeds are slender and pediform, with the 2nd joint (basis-ischium-merus) slightly arched outwards, and with a flagelliform exopodite but no epipodite.

The exopodites of the thoracic legs are well-developed, but only in the case of the reduced 4th pair do they approach anywhere near to the length of the endopodites.

The first two pairs of thoracic legs are far longer and stouter than any of the others: they end in longish chelæ, which have longer slender hooked-fingers with very elegantly and evenly pectinate teeth.

The 3rd, 4th and 5th pairs are slender (especially the 3rd pair) and short, the 4th pair being about half the length of the other two.

The abdominal appendages are biramous and narrowly foliaceous, the exopodites being of ordinary length and (except in the case of the 1st pair) not twice as long as the endopodites: all behind the 1st pair have the usual styli-form appendix at the inner edge of the endopodite.

The eggs though fairly numerous are large.

The branchial formula is as follows:—

Somites and Appendages.	Podobranchiæ and Epipodites.	Arthrobranchiæ.	Pleurobranchiæ.	
VII, VIII, IX	0	0	0	= 0
X	0	1	1	= 2
XI	0	1	1	= 2
XII	0	1	1	= 2
XIII	0	0	1	= 1
XIV	0	0	1	= 1
Total	0	3	5	= 8

## 28. *Pasiphaea sicado*, (Risso).

*Alpheus sicado*, Risso, Hist. Nat. Crust. Nice, p. 93, pl. iii, fig. 4.

*Pasiphaea sicado*, Leach, Malac. Pod. Brit. pl. xxxvii C. fig. 3. Desmarest, Consid. Gen. Crust. p. 240: Guérin Icon. Règne Anim. Cuv. pl. xxii. fig. 3: Risso, Hist. Nat. Eur. Mèrid. V., p. 81: Milne Edwards, Hist. Nat. Crust. 11, 426: Bell, Brit. Stalk-eyed Crust. p. 312: Heller, Crust. Sudl. Europ. p. 243: Sars, Vid. Selsk. Forh. Christiania, 1882, No. 18, p. 18: Carus, Prodr. Faun. Medit. I., p. 481: Ortmann, Zool. Jahrb., Syst., V., 1900-91, p. 463: Wood-Mason, Ann. Mag. Nat. Hist. (6) XI., 1893, p. 161: Adensamer, Denk. Ak. Wien., LXV., 1898, p. 626.

*Pasiphaea Savignyi*, Leach MSS., Milne Edwards, Hist. Nat. Crust. 11., 426.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE III, FIG. 6.

Carapace, measured in the middle line, about half the length of the abdomen without the telson, compressed but not carinated.

Rostrum a small obliquely-ascendant procurved frontal spine arising behind the frontal margin.

The 6th abdominal tergum, which is only about half as long again as the 5th, ends in a sharp median spine. Telson not forked, a good deal shorter than the narrow endopodite of the caudal swimmeret, which again is shorter than the exopodite.

Eyes hardly wider than their stalks, decidedly oblique.

The antennular peduncle reaches about two-thirds of the way along the antennal scale, the basal joint is the longest, the middle joint the shortest: the antennular scale does not quite reach the end of the basal joint: the outer flagellum, which is a good deal longer than the inner, is longer than the entire body. The antennal scale is not quite half as long as the carapace, its outer edge is thickened and ends acutely.

The external maxillipeds are hardly stouter than the 3rd pair of legs, they reach beyond the antennal scale by about half their terminal joint.

The first two pairs of legs have a single spine at the far end of the posterior border of the basipodite, and a series of spines along the same border of the meropodite, and a large spine at the far end of the same border of the very short carpus. The 1st pair reach beyond the antennal scale by half the length of the hand, the hand forms nearly two-fifths of their total length, and the fingers are shorter than the palm. The 2nd pair, which are the longest, are a little over half the length of the body without the telson; their hand, in which the fingers are quite as long as the palm, is also about two-fifths of their total length.

The 3rd and 5th pair of legs are nearly as long as the carapace, but the 4th pair are only half that length. In the 3rd pair the terminal joints are filiform: in the 5th pair the terminal joint is short, oval, and furnished with very long setæ.

In an egg-laden female the length of the carapace, measured in the middle line is 14 millim., of the abdomen 34 millim.

Andaman Sea 200 fathoms: Bay of Bengal 200-350 fathoms.

Regd. Nos.  $\frac{509-510}{7}$ :  $\frac{9278}{9}$ .

## 29. *Pasiphaea unispinosa*. Wood-Mason.

*Pasiphaea unispinosa*, Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1893, p. 163.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE III. FIG. 7.

Differs from *P. sivado* in the following characters:—

The post-frontal spine is stronger and is continued backwards, almost to the posterior border of the carapace, as a distinct carina. The eyes are much larger.

A ridge, which is oblique and sinuous in the anterior and straight in the posterior part of its course, runs from the orbital sinus nearly to the posterior

border of the carapace, giving off, on the hepatic region, a branch that runs obliquely towards the lower border of the carapace.

The sixth abdominal somite is deeper, its tergum is more convex and is not produced to a spine posteriorly.

In the first pair of legs the meropodite is unarmed, and in the 2nd pair there is only one spine on the posterior border of the meropodite.

The 5th pair of legs though of the same form as those of *P. sirado*, and though not reduced in length, are yet considerably shorter and stouter than the 3rd pair.

It is a larger species, the carapace of an egg-laden female, measured in the middle line, being 39 millim., and the abdomen 82 millim.

Andaman Sea 265 and 405 fathoms: Bay of Bengal, 200-350 fathoms: Arabian Sea 360 and 609-620 fathoms.

Regd. No.  $\frac{1960}{10}$  (Type of the species):  $\frac{3114}{9}$ :  $\frac{1168}{10}$ :  $\frac{1723}{10}$ .

#### Subgenus *Phye*, Wood-Mason.

*Phye*, Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1893, p. 164.

Differs from *Pasiphæa* in having the tip of the telson forked. In all other respects, including the number and arrangement of the gills, it agrees with *Pasiphæa*.

### 30. *Pasiphæa (Phye) alcocki*, Wood-Mason.

*Parapasiphæa alcocki*, Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 196.

*Phye alcocki*, Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1893, p. 164.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA. PLATE III. FIG. 5, AND PLATE LII. FIG. 6.

Resembles *P. unispinosa* in the form of the carapace, and *P. sirado* in the armature of the meropodites of the first two pairs of legs, but differs from the latter species in the following characters:—

The rostrum is not a spine, but a high compressed tooth the anterior edge of which is vertical and sinuous: it is continued backwards, almost to the posterior border of the carapace, as a sharp carina.

As in *P. unispinosa* a ridge, which is sinuous and oblique in its anterior and straight and nearly horizontal in its posterior part, runs from the orbital sinus nearly to the posterior border of the carapace, giving off an obliquely descending branch on the hepatic region.

The 6th abdominal tergum is not produced to a spine posteriorly in the middle line.

The tip of the telson is deeply forked in the middle line, the inner edge of the branches being elegantly serrated.

The eyes are pale brown, and the antennular scale is twisted.

The external maxillipeds are much stouter than any of the last 3 pairs of legs, and reach beyond the antennal scale by about a fourth of their terminal joint.

The first two pairs of legs are like those of *P. sivado*, except that the posterior border of the carpus of the 1st pair is not produced to a spine. The 5th pair of legs are much stouter than the 3rd pair, but are otherwise as in *P. sivado*.

Colour in life deep crimson.

In the largest specimen the median length of the carapace is 25 millim., of the abdomen 54 millim.

Bay of Bengal, 922 fathoms: Gulf of Manár 406 fathoms: Arabian Sea, off the Sind coast, 947 fathoms.

Regd. No.  $\frac{6107}{19}$  (Type of the species):  $\frac{290}{10}$ :  $\frac{335}{10}$ :  $\frac{535}{10}$ .

#### SYMPASIPHEA, *nov. gen.*

Body compressed. Carapace of fair length, produced to form a normal though short rostrum, and furnished with an orbital and a post-antennal spine. Abdominal pleura deep and wide: telson of good length, acute.

Eyes of fair size, not oblique.

Mandibles with a slender almost straight palp. The 2nd maxillæ have the coxa and basis distinguishable, but extremely small. The 1st maxillipeds have the epipodite quite distinct and the endopodite distinguishable. The 2nd maxillipeds consist of a 7-jointed pediform endopodite, the terminal joint of which is a recurved claw-like dactylus: they have no exopodite, and the epipodite is represented by a tiny papilla. The external maxillipeds differ from those of *Pasiphæa* only in having a small epipodite.

The legs only differ from those of *Pasiphæa* in respect of the 5th pair, which, instead of being nearly as long as the 3rd pair, are no longer than those of the reduced 4th pair.

The antennules, antennæ, and 1st maxillæ are as in *Pasiphæa*.



The branchial formula is as follows:—

Semites and Appendages.	Podobranchiæ.	Pleurobranchiæ.	Arthrobranchiæ.		
VII	ep.	0	0	=	ep.
VIII	ep.r.	0	0	=	ep.r.
IX	ep. small.	1	0	=	1 + ep.
X	0	1	1	=	2
XI	0	1	1	=	2
XII	0	1	1	=	2
XIII	0	1	1	=	2
XIV	0	0	1	=	1
Total	2 ep. + ep.r.	5	5	=	10 + 2 ep. + ep.r.

From *Parapasiphæa* this genus differs in having only one arthrobranch to the external maxillipeds, and the epipodite of the 2nd maxillipeds reduced to a microscopic rudiment: the body is more compressed and the 5th pair of legs more reduced in length.

Perhaps it should be regarded as a subgenus of *Parapasiphæa*.

### 31. *Sympasiphæa annectens*, n. sp.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE LII. FIG. 7.

Rostrum thin, compressed, ascendant, projecting beyond the eyes, armed a little beyond the middle of the ventral surface with a single spine, produced nearly to the posterior border of the carapace as a sharp carina the gastric portion of which is armed with 5 teeth.

From the post-orbital spine a ridge runs backwards, and after an initial sinuous course passes across the branchial region almost to the posterior border of the carapace.

From the post-antennal spine another ridge runs backwards and after giving off a short branch that joins the post-orbital ridge, sweeps down and for a short distance runs nearly parallel with the lower border of the carapace.

The 2nd and 3rd abdominal terga are faintly carinate, the 4th and 5th are sharply carinate up to a sharp spine in the middle of the posterior border of each. Telson with a spinose tip, a little shorter than the endopodite of the tail-fan, which again is a good deal shorter than the exopodite. Eyes brown: a small papilla on inner side of eyestalk.

The antennular peduncle reaches about two-thirds of the way along the antennal scale: its basal joint is the longest and its middle joint the shortest: its scale, which is nearly as long as the basal joint, ends acutely.

The antennal scale is not half the length of the carapace proper; in addition to a midrib, its outer edge also is thickened and ends in a long spine. There is a very strong declivous spine on the ventral border of the 2nd joint of the antennal peduncle.



The external maxillipeds reach about three-fourths of the way along the antennal scale: they are stouter than any of the last three pairs of legs, and their 2nd joint (basis-ischium-merus) is somewhat broadened distally.

The 1st two pairs of legs are similar in form, being much the stoutest and longest of all, the 2nd pair, which are the longer, are about half the length of the body including the rostrum and tail-fan. In the 1st pair there is a spine on the posterior border of the basis and a few spines along the same border of the merus, and the fingers are a little shorter than the palm, the whole hand forming not quite two-fifths the total length of these appendages. In the 2nd pair there is a spine on the posterior border of the basis and a series of spines along the same border of the merus, the posterior border of the carpus is produced distally to a very large spine, and the fingers are hardly as long as the palm, the whole hand forming more than two-fifths the total length of these appendages.

The 3rd pair of legs are broken in the single specimen. The 4th and 5th pair are nearly alike, their length is about two-fifths that of the carapace proper and their terminal joint is coarse and setose.

In the single specimen dredged the length of the carapace and rostrum is 30 millim. (the rostrum contributing a little over 5 millim.) and of the abdomen 45 millim., measured in the middle line.

From the Arabian Sea, south-west of C. Comorin, 487 fathoms.

Regd. No.  $\frac{3817}{10}$  (Type of the species.)

#### PARAPASIPHEA, S. I. Smith.

*Parapasiphea*, S. I. Smith, Albatross Crust. in Rep. U. S. Fish. Comm. for 1882 (1884), p. 383.

Body only moderately compressed. Carapace of fair length, produced to form a normal, though short, rostrum: a post-orbital and post-antennal spine may be present.

Abdominal pleura wide and deep: telson acute, of fair length.

Eyes of fair size, not oblique: the eye-stalks are vertically compressed and have a small papilla on their inner edge.

The mandibles have a slender, almost straight, two-jointed palp. In the 2nd maxillæ the coxa and basis are small but quite distinct. The 1st maxillipeds have a large epipodite and a small but distinct endopodite. The 2nd maxillipeds consist of a 7-jointed endopodite and a small epipodite: their terminal joint is a spinose dactylus. The external maxillipeds differ from those of *Pasiphea* only in having a small epipodite.

The thoracic legs are as in *Pasiphea*, except that the 5th pair are much shorter.

The antennules, antennæ, and 1st maxillæ are as in *Pasiphæa*.  
The branchial formula is as follows :—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.	Pleurobranchiæ.
VII	ep.	0	0 = ep.
VIII	ep.	0	0 = ep.
IX	ep.	2	0 = 2+ ep.
X	0	1	1 = 2
XI	0	1	1 = 2
XII	0	1	1 = 2
XIII	0	1	1 = 2
XIV	0	0	1 = 1
Total.	3 ep.	6	5 = 11+3 ep.

From *Sympasiphæa* this genus differs in having 2 arthrobranchiæ to the external maxillipeds, and a distinct epipodite to the 2nd maxillipeds: the body is less compressed, the dactylus of the external maxillipeds differs in form, and the 5th pair of thoracic legs is not so much reduced in length.

*Key to the Indian species of Parapasiphæa.*

- I. The dorsal carina of the carapace is armed on the gastric region only with about 5 teeth: the rostrum is a high compressed leaf, with its tip deeply excised ... .. *P. latirostris*.
- II. The dorsal carina of the carapace is closely serrated in all its extent: the rostrum is an acute up-curved spine ... .. *P. Gilesii*.

32. *Parapasiphæa latirostris*, Wood-Mason.

*Parapasiphæa latirostris*, Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 196, and Feb. 1893, p. 166, fig. 2.  
ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE LII. FIG. 1.

Carapace and rostrum, measured in the middle line, not far short of the length of the first six abdominal somites: the surface of the carapace is curiously vermiculated with wrinkles.

Rostrum a high thin strongly convex crest, reaching beyond the end of the eyestalk but not beyond the eye, and having its tip broadly excised so as to form two teeth: it is continued backwards, nearly to the posterior border of the carapace, as a distinct carina the gastric portion of which is armed with 5 small teeth.

On the frontal margin the orbital and antennal angles are bluntly defined, and instead of a branchiostegal angle there is a deep sinus: behind and above the orbital angle is a minute spine, and above the branchiostegal sinus there is a much larger one: from the latter spine a ridge runs nearly straight backwards towards the posterior border of the carapace, giving off, on the hepatic region, a branch that runs obliquely backwards towards the very well defined lower

border of the carapace: from the post-orbital spinule a ridge runs obliquely backwards to join the post-antennal ridge.

Traces of carination occur on the first two abdominal terga, the 3rd tergum is carinated in the greater part of its extent, the 4th is carinated throughout and the carina is produced posteriorly to a spine of some size, and the 5th and 6th are longitudinally wrinkled dorsally. The telson is shorter than the endopodite and much shorter than the exopodite of the caudal fan.

Eyes brown, as wide as their stalks. The antennular scale, which is foliaceous with a sharp tip, is as long as the basal joint of the antennular peduncle. The antennal scale is not quite half the length of the carapace proper: it is acutely elongate-oval, and in addition to a stout midrib, has its outer border thickened up to a strong terminal spine.

The external maxillipeds, which are stouter than any of the last three pairs of legs, reach almost to the tip of the antennal scale: all their joints are setose, the 2nd (basis-ischium-merus) being a good deal broadened in its distal half.

The first two pairs of legs are similar in form, the 2nd pair, which are the longer, being half the length of the body including the rostrum and tail-fan. In the 1st pair the posterior border of the merus and palm are serrated, the distal angles of the wrist—especially the posterior one—are produced, the fingers are nearly as long as the palm, and the hand is more than a third the total length. In the 2nd pair the posterior border of the basis, ischium, merus and palm is serrated, the distal end of the posterior border of the wrist is very strongly produced, the fingers are nearly as long as the palm, and the hand is more than two-fifths the total length.

The filiform 3rd pair are about as long as the carapace and rostrum. The 4th and 5th pair have the terminal joint truncate at tip and setose: the 5th pair, which are the longer, are not half the length of the carapace.

In an egg-laden female the length of the rostrum and carapace is 54 millim. (the rostrum contributing about 7.5 millim.) and that of the abdomen is 82 millim.

Colour in life deep lurid red.

From the Laccadive Sea, 595–556, 696, and 740 fathoms.

Regd. Nos.  $\frac{6079}{9}$  (Type of the species):  $\frac{9273}{9}$  :  $\frac{3850}{10}$ .

### 33. *Parapasiphæa Gilesii*, Wood-Mason.

*Parapasiphæa Gilesii*, Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1893, p. 166.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE III. FIG. 8.

Differs from *P. latirostris* in the following characters:—

The vermiculate wrinklings of the carapace are finer and less distinct.

The rostrum is a fine acute upcurved spine, about a third of its length lying beyond the eyes: its carina, which is continued backwards nearly to the posterior border of the carapace and is a little concave at the cervical groove, is *fairly closely and evenly serrated in its whole length*, the first serration, which is situated on the rostrum itself, being larger than any of the others.

In addition to the ridges present on the carapace in *P. latirostris*, a branch marks off the upper limit of the posterior part of the branchial region.

The spine in which the carina of the 4th abdominal tergum ends, though not larger than that of *P. latirostris*, is more salient.

The antennular scale is shorter than the basal joint of the peduncle.

The external maxillipeds reach a little way beyond the antennal scale.

The legs are almost exactly the same as those of *P. latirostris*, only the 2nd pair are considerably more than half the length of body.

In the largest specimen the length of the carapace is 26.5 millim. (the rostrum contributing more than 5 millim.) and that of the abdomen is 37 millim.

Andaman Sea 650 fathoms: Arabian Sea, north of the Laccadives, 696 fathoms.

Regd. Nos.  $\frac{8588}{6}$  (Type of the species):  $\frac{9277}{9}$ .

#### PSATHYROCARIS, Wood-Mason.

*Psathyrocaris*, Wood-Mason, in Rep. Marine Survey of India, 1890-91, p. 19, and Ann. Mag. Nat. Hist., Feb. 1893, p. 168.

Integuments extremely thin, appendages delicate and very fragile.

Body moderately compressed: carapace of good length, produced to form a normal, though short, rostrum. The orbital angle is sharp but there are no spines on the carapace. Abdominal pleura deep and wide: telson acute.

Eyes and eyestalks vertically compressed: a papilla on the inner edge of the eyestalk: eyes not, or little, oblique.

Antennular peduncle of fair length, its scale comparatively large. Antennal scale rather broad.

Mandibles with a large straight two-jointed palp.

The 1st and 2nd maxillæ and the 1st maxillipeds are perfectly normal in all parts, the coxa and basis being well developed. The 2nd maxillipeds have a 7-jointed pediform endopodite the terminal joint of which is a normal dactylus, a minute exopodite, an epipodite and a gill-plume. The external maxillipeds are pediform and have a rudimentary exopodite and a small epipodite.

The exopodites of the last four pairs of thoracic legs, like those of the first five pairs of abdominal legs, are of extraordinary length.



The first two pairs of thoracic legs resemble those of *Pasiphæa* and other allied genera: they are longer and very much stouter than any of the others, the 2nd pair being longer than the 1st, and they end in elongate chelæ with long slender hooked fingers: in the 2nd pair the fingers, in addition to the close-set comb of teeth found in other *Pasiphæidæ*, are armed with long acicular teeth at regular intervals.

The 3rd and 4th pair of legs are long and filamentous, the endopodites longer than the exopodites. The 5th pair are stouter than the 3rd and 4th and end in a stoutish flexed dactylus: the exopodite in this pair is longer than the endopodite.

The abdominal appendages are biramous and are remarkable for the slenderness of both rami, and for the enormous length of the exopodites. The short endopodites have the usual internal appendix, while is filiform. The exopodite of the caudal swimmerets (which are of the usual form) is incompletely fissured transversely.

The eggs are few and large.

The branchial formula is as follows:—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.	Pleurobranchiæ.
VII	(ep.)	0	0 = ep.
VIII	1 (ep.)	0	0 = 1 + ep.
IX	(ep.)	2	0 = 2 + ep.
X	0	1	1 = 2
XI	0	1	1 = 2
XII	0	1	1 = 2
XIII	0	1	1 = 2
XIV	0	0	1 = 1
Total	1 + 3 ep.	6	5 = 12 + 3 ep.

#### Key to the species of *Psathyrocaris*.

- I. The dorsal edge of the rostrum is flush with the gastric carina: the 2nd pair of thoracic legs are as long as the whole body without the telson, their merus is smooth and articulates end to end with the moderately long carpus:—
  1. Eyestalks moderately depressed:—
    - i. Integument smooth: appendages sparsely setose ... *P. fragilis*.
    - ii. Integument furfuraceous: appendages thickly setose ... *P. plumosa*.
  2. Eyestalks sublaminar ... .. *P. platyophthalmus*.
- II. The rostrum is humped dorsally: the 2nd pair of legs are half the entire length of the body, their merus has its posterior border serrated and articulates with the middle of the posterior border of the extremely short carpus ... .. *P. infirma*.



34. *Psathyrocaris fragilis*, Wood-Mason.

*Psathyrocaris fragilis*, Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1893, p. 171, pls. x. xi: Caullery, Candan Crust. in Ann. Univ. Lyon, 1896, p. 374, pl. xiv. figs. 12-15.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE LIII. FIG. 5.

Rostrum horizontal, reaching nearly to the end of the eye and continued backwards as a gastric crest: its ventral edge forms a convex lamina, its dorsal edge is armed with some minute teeth as is also the anterior end of the gastric crest.

From the orbital angle a ridge takes a sinuous course backwards almost to the posterior border of the carapace, giving off in the hepatic region a branch that runs obliquely backwards towards the lower border of the carapace. The 6th abdominal somite is slender and twice as long as the 5th.

Eyestalks moderately depressed: eyes nearly black, more ventral than dorsal in position.

The antennular scale reaches nearly to the end of the 2nd joint of the antennular peduncle and is fluted and twisted. The antennal scale is about half the length of the carapace proper: it has a midrib, and its outer border also is thickened and ends acutely.

The external maxillipeds reach a little beyond the antennal scale: their 2nd joint is thin and broadish, the next three joints are slender.

The 1st pair of legs are not quite half the total length of the body: their hand, in which the fingers are less than two-thirds the length of the palm, is not quite a third their total length, and the fixed finger alone has pectinate teeth: all their joints are smooth and their exopodite is small.

The 2nd pair are about as long as the whole body without the telson: their hand, in which the fingers are not much shorter than the palm, is more than two-fifths their total length: all their joints are smooth and their exopodite is of good length.

The filiform 3rd and 4th pair are actually longer than the 1st pair: though their exopodites are very long they are not so long as the endopodites.

The 5th pair, which are about as long as the carapace, are fairly stout: the posterior border of their propodite is setose, especially at the distal end, and the setose dactylus, which appears to be permanently more or less flexed, seems to be capable of complete flexion on to a special tuft of setæ at the far end of the posterior border of the propodite.

The filiform exopodites of the first five pairs of abdominal appendages are infinitely longer than the endopodites: the exopodites of the 1st pair are about as long as the distance between the tip of the rostrum and the 5th abdominal somite.

In life the body is of a ruddy colour.

In an average specimen the median length of the carapace and rostrum is 23 millim., of the abdomen 38 millim., of the exopodite of the 1st abdominal appendages about 38 millim.

Bay of Bengal, 240 and 609 fathoms : Arabian Sea, off the Malabar coast, 172 fathoms, off the Sind coast, 609-620 fathoms.

Regd. Nos.  $\frac{6828-6829}{9}$  (Types of the species) :  $\frac{6827}{9}$  :  $\frac{6831-6839}{9}$  :  $\frac{9280}{9}$  :  $\frac{9282}{9}$  :  $\frac{1167}{10}$ .

### 35. *Psathyrocaris plumosa*, Alcock and Anderson.

*Psathyrocaris plumosa*, Alcock and Anderson, Journ. Asiatic Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 159.  
ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XII. FIG. 5.

Differs from *P. fragilis* only in the following points :—

The integument is covered with a fine short branny tomentum, and the appendages are much more setose.

The rostrum is a little longer and the eyes are of a light brown colour.

The terminal joint of the external maxillipeds is a little broader.

In the 2nd pair of thoracic legs the fingers are quite as long as the palm, and the teeth are stronger.

From the Arabian Sea, off the Travancore coast, 902 fathoms.

Regd. No.  $\frac{9281}{9}$  (Type of the species).

### 36. *Psathyrocaris platyophthalmus*, Alcock and Anderson.

*Psathyrocaris platyophthalmus*, Alcock and Anderson, Journ. Asiatic Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 158.  
ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XII. FIG. 6.

The only points in which this species differs from *P. fragilis* are the following :—

The eyestalks are so much compressed vertically as to be sublaminar, and only a thin crescent of the eye can be seen in a dorsal view.

The antennular scale reaches about halfway along the 2nd joint of the antennular peduncle.

In an egg-laden female the median length of the carapace and rostrum is 34 millim., of the abdomen 59 millim., of the exopodites of the 2nd pair of abdominal appendages 52 millim.

Colour in life crimson.

The eggs are few (in one specimen 6, in another 9) and are of enormous size, having a major diameter, even after contraction in spirit, of not less than 6 millim.

In the original notice of the species the abdominal exopodites were said to be shorter than those of *P. fragilis*, but the examination of further and better preserved material shows that this is not the case to any marked extent.

Bay of Bengal, 409 fathoms : Arabian Sea, in the vicinity of the Laccadives, 705 fathoms.

Regd. Nos.  $\frac{9283}{9}$  (Type of the species) :  $\frac{6287-6288}{9}$ .

37. *Psathyrocaris infirma*, Wood-Mason MS.

*Psathyrocaris infirma*, Alcock and Anderson, Journ. Asiatic Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 159.  
ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XII. FIG. 7.

Differs from *P. fragilis* in the following particulars:—

The rostrum, which otherwise is similar, is strongly humped dorsally, instead of being flush with the gastric carina, and this carina is carried farther backwards.

The post-orbital ridge of the carapace is straighter and its branch that runs towards the lower border of the carapace gives off a loop that rejoins the post-orbital ridge.

The antennular scale does not reach to the end of the basal joint of the antennular peduncle.

The 1st pair of thoracic legs are not much longer than the carapace and rostrum, and more than two-fifths of their length is contributed by the hand : the carpus is an extremely short joint with its anterior border bulging strongly beyond its articular facets : the fingers are less than half the length of the palm : the exopodite is long.

The 2nd pair of legs are about half the length of the body : the merus has its posterior border serrated and has a strong spine at the distal end of its anterior border : the carpus is a curious short ovoid joint, receiving the articulation of the merus in the middle of its posterior border : the fingers are only half the length of the palm, and their teeth are stronger than in *P. fragilis*.

The 5th pair of legs, though otherwise similar, are longer than the carapace and rostrum, and their exopodite is shorter than their endopodite.

In the abdominal legs behind the first pair the endopodites are about a sixth the length of the exopodites. In the first pair the exopodites are as long as the carapace (and rostrum) and first abdominal somite.

Colour in life, crimson.

Andaman Sea, 405 fathoms.

Regd. No.  $\frac{6810}{9}$  (Type of the species).

Family *Hoplophoridae*, Faxon.

*Acanthephyridæ* (part) and *Tropiocaridæ*, Spence Bate, Challenger Crust. Macrura, pp. 481, 927.

*Acanthephyridæ*, Stobbing, Hist. Crust., p. 242.

*Acanthephyridæ* (part), Ortmann in Bronn's Thier Reich, Arthropoda, p. 1125.

*Hoplophoridae*, Faxon, Mem. Mus. Comp. Zool., XVIII. 1895, p. 159.

Rostrum either moderately or very well developed. Antennular scale small or quite rudimentary. Antennal scale long, narrow, more or less tapering.

Mandible with a stout 3-jointed palp and with the incisor and molar processes distinct but almost confluent, the molar process being small. The 1st and 2nd maxillæ and the 1st maxillipeds have the coxa and basis well developed, though the coxa of the 2nd maxillæ is strongly receding. The exopodite of the 1st maxillipeds is a broad simple falciform plate, without a flagellum.

The terminal segment of the 2nd maxillipeds is variable: sometimes it is a narrow plate attached along all its extent to the inner border of the propodite as if it were a small complementary piece of that segment, sometimes it is a distinct and independent dactylus. External maxillipeds stout, pediform.

All eight pairs of thoracic appendages have well developed exopodites.

The first two pairs of thoracic legs end in small but well formed chelæ, the 2nd pair having the carpus unsegmented. The last three pairs are of moderate length—the longest of them being never much longer than the carapace and rostrum combined, if so long—and are of nearly equal size.

*Synopsis of the genera of Hoplophoridae of the Indian Necton.*

- |     |   |     |     |               |
|-----|---|-----|-----|---------------|
| I.  | Outer edge of antennal scale sharply serrated. Exopodites of all the maxillipeds and of the 1st pair of legs foliaceous         | ... | ... | HOPLOPHORUS.  |
| II. | Outer edge of antennal scale entire: all the exopodites behind those of the 1st maxillipeds have the usual lax lash-like form:— |     |     |               |
|     | 1. The thoracic legs are of the usual slender form  | ... | ... | ACANTHEPHYRA. |
|     | 2. Some or all of the thoracic legs have the ischium and merus broad, compressed and leaf-like                                  | ... | ... | EPHYRINA.     |

## HOPLOPHORUS, Edw.

*Oplophorus*, Milne Edwards, Hist. Nat. Crust. II. p. 423: Spence Bate, Challenger Crustacea Macrura, p. 760.

Body compressed. Rostrum long slender, serrated dorsally and ventrally. Carapace smooth, articulating with the abdomen on either side by a process which is held by the produced antero-lateral angle of the 1st abdominal tergum: an antennal and a branchiostegal spine are present, in addition to the much inflected orbital tooth.

Abdomen more or less carinated, the carinæ of the 3rd, 4th, and 5th terga produced backwards as long spines. Abdominal pleura deep but not very broad fore-and-aft, except those of the 2nd somite in the female; those of the 3rd, 4th, and 5th somites are more or less falcate. Telson long and very acute.



Eyes of good size: a small "ocellus" is present but, lying inside the corneal margin, is inconspicuous.

Antennular peduncle short: the 1st joint is deeply concave dorsally for the eye, and its scale is indicated merely by button-hole slit in its outer border: two antennular flagella of good length, the outer one thickened at base.

Antennal scale narrow, tapering, extremely acute, its outer edge strongly serrated: it is supported by a strong scapulate tooth springing from the outer aspect of the 2nd joint of the peduncle.

Exopodites of the maxillipeds and of the anterior legs foliaceous, those of the last 3 or 4 pairs of legs having the ordinary form. Though the terminal joint of the 2nd maxillipeds articulates obliquely with the penultimate joint, yet it is nearly as long as broad.

External maxillipeds stout, pediform. Thoracic legs not elongate, the longest of them being not much longer than the carapace without the rostrum: the first two pairs are a little more robust than the others and end in well-formed chelæ.

All the abdominal appendages are biramous and those behind the 1st pair have the usual styliform appendix at the base of the endopodite. The exopodite of the caudal fan is divided by a very fine transverse suture.

Eggs large and few.

The branchial formula is as follows:—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.	Pleurobranchiæ.	
VII	0 (ep.)	0	0	= 0 + ep.
VIII	1 (ep.)	0	0	= 1 + ep.
IX	0 (ep.)	2	0	= 2 + ep.
X	0 (ep.)	1	1	= 2 + ep.
XI	0 (ep.)	1	1	= 2 + ep.
XII	0 (ep.)	1	1	= 2 + ep.
XIII	0 (ep.)	1	1	= 2 + ep.
XIV	0	0	1	= 1
Total	1 + 7 ep.	6	5	= 12 + 7 ep.

The epipodite of the penultimate thoracic legs (XIII) is a hard plate which does not ascend between the gill-plumes.

### 38. *Hoplophorus gracilirostris*, A. M. Edw.

*Oplophorus gracilirostris*, A. Milne Edwards, Ann. Sci. Nat., Zool., (6) XI. 1881, Art. 4, p. 6, and Rec. Fig. Crust., pl. 29.

*Hoplophorus smithii*, Wood-Mason, Ann. Mag. Nat. Hist. (6) VII, 1891, p. 194.

*Hoplophorus gracilirostris*, Wood-Mason, Ann. Mag. Nat. Hist. (6) IX. 1892, p. 365.

Rostrum slender, upcurved, as long as up to  $1\frac{1}{2}$  times the rest of the carapace, produced as a sharp carina to the posterior border of the carapace:



it is armed dorsally with 10-14 (commonly 11), ventrally with 7-8 (usually 7) teeth, and on either side its base is buttressed by a carina which extends as far as the middle of the gastric region.

The inflexed postero-lateral angles of the carapace are produced to form a slightly everted tooth.

The spine of the 3rd abdominal tergum is very much longer than those of the 4th and 5th.

In the female the anterior lobe of the pleuron of the 1st abdominal somite is intact, and the pleura of the 2nd abdominal somite are broader (fore and aft) than deep: in the male the anterior border of the pleuron of the 1st abdominal somite is deeply excised with the lower or posterior angle of the notch pronounced and usually produced, and the pleura of the 2nd somite are at least as deep as broad. The telson is longer than the caudal swimmerets.

Antennular peduncle very short, the basal joint the longest: the flagella are as long as the carapace *plus* about half the rostrum. The antennal scale is not much shorter than the carapace.

The external maxillipeds are the stoutest of all the thoracic appendages and the longest excepting the 3rd pair of legs, reaching beyond the end of the antennal peduncle by more than half their terminal joint: their second segment (basis-ischium-merus) is strongly arched with the convexity outwards.

The first two pairs of legs reach to the base of the terminal joint of the external maxillipeds and are very similar in form: the 1st pair differs in having the exopodite foliaceous, the wrist and the palm somewhat inflated, and the fingers a little shorter than those of the 2nd pair: the latter have a spine near the far end of the lower border of the merus.

The 4th and 5th pair of legs are decidedly shorter than the 3rd pair, which last reach slightly beyond the tips of the 1st pair. The lower border of the ischium and merus of the 3rd and 4th pairs is more or less spinous.

In an egg-laden female the rostrum is 22.5 millim. long, the carapace 15.5 millim., and the abdomen 34.5 millim. In a large male the rostrum is 22 millim. long, the carapace 16 millim., and the abdomen 32 millim.

Colours in life: bright transparent red, with golden patches on the abdominal pleura and last 3 pairs of thoracic legs: tail-fan colourless. Eggs purplish red.

Found here in the Andaman Sea, in 185, 188-220, and 370-419 fathoms; in the Bay of Bengal, in 145-250, 272, 200-350, 364, 594-225, 609, 1260 and 1439 fathoms; and in the Arabian Sea, near the Laccadives, in 406 fathoms.

*Hoplophorus longirostris*, Spence Bate, from off Fiji, is almost certainly this species.

Regd. Nos.  $\frac{4254}{7}$  :  $\frac{6091-6092}{9}$  :  $\frac{6264}{9}$  :  $\frac{6748-6749}{9}$  :  $\frac{9234-9235}{9}$  :  $\frac{799-803}{10}$  :  $\frac{1866}{10}$  :  $\frac{2123-2125}{10}$  :  
 $\frac{2525-2576}{10}$  :  $\frac{3826-3830}{10}$ .

## ACANTHEPHYRA, A. M. Edw.

*Acanthephyra*, A. Milne Edwards, Ann. Sci. Nat. Zool., (6) XI. 1881, Art. 4, p. 12: S. I. Smith, Albatross Crust. in Rep. U.S. Fish Comm. for 1882 (1884), p. 372: Spence Bate, Challenger Crust. Macrura, p. 730: Faxon, Mem. Mus. Comp. Zool. XVIII. 1895, p. 160.

Body compressed. Rostrum usually long and armed with teeth both dorsally and ventrally, rarely short. Carapace smooth, without any special mode of articulation with the abdomen: a post-antennular and post-antennal spine are present, in addition to the blunt orbital angle.

Abdomen more or less carinated, the carinae of some of the terga ending posteriorly in a tooth or spine. Abdominal pleura deep and wide. Telson acute.

Eyes variable in size: a small "ocellus" sometimes present.

Antennular peduncle short: the 1st joint dorsally concave for the eye, and having a small "scale" at the base of its outer margin: two antennular flagella, of good length, the outer one thickened at base. Antennal scale long and narrow, the outer edge smooth and ending in a little spine: a spine of ordinary form exists at the far end of the outer border of the 2nd joint of the antennal peduncle.

Exopodite of 1st maxillipeds broadly foliaceous: those of all the other thoracic appendages have the ordinary lashlike form.

The terminal segment of the 2nd maxillipeds sits so obliquely against the inner border of the propodite as to appear like a complementary piece of the latter segment.

External maxillipeds stout, pediform, the second segment (basis-ischiomerus) arched outwards.

The thoracic and abdominal legs are as in *Hoplophorus*.

The eggs, as far as is known, are small and numerous.

The branchial formula is exactly the same as that of *Hoplophorus*, except for the absence of a rudimentary epipodite from the penultimate pair of thoracic legs, and is as follows:—

Somites and appendages.	Pedobranchiæ.	Arthrobranchiæ.	Pleurobranchiæ.	
VII	(ep.)	0	0	= + ep.
VIII	1 (ep.)	0	0	= 1 + ep.
IX	(ep.)	2	0	= 2 + ep.
X	(ep.)	1	1	= 2 + ep.
XI	(ep.)	1	1	= 2 + ep.
XII	(ep.)	1	1	= 2 + ep.
XIII	0	1	1	= 2
XIV	0	0	1	= 1
Total	1 + 6 ep.	6	5	= 12 + 6 ep.

*Synopsis of the Indian species of AcanthePHYRA.*

- I. The 6th abdominal somite is not twice as long as the 5th: the dactyli of the 3rd and 4th thoracic legs are short, and those of the 5th pair are minute and hidden in a tuft of setæ:—
1. The rostrum is long: it and the carapace combined are at least as long as the abdomen without the telson:—
    - i. The eyes are wider than the eyestalks, and are black or dark brown:—
      - A. Post-antennal spine of carapace of good size: telson shorter than the exopodite of the tail-fan:—
        - a. Carapace very distinctly carinated in the middle line in almost all its extent: no carina runs from the post-antennal spine to the end of the hepatic groove:—
          - α. Four (or rarely more) teeth on the ventral border of the rostrum ... .. *A. eximia.*
          - β. Only three teeth on the ventral border of the rostrum ... .. *A. brachytelsonis.*
        - b. Carapace almost imperceptibly carinated in rear of the gastric region: a sharp buttress-like crest runs from the post-antennal spine to the end of the hepatic groove ... .. *A. armata.*
      - B. Post-antennal spine minute: telson longer than the exopodite of the tail-fan ... .. *A. sanguinea.*
    - i. The eyes are narrower than the eyestalks and are light brown in colour ... .. *A. microphthalmus.*
  2. The rostrum is short: it and the carapace combined are only half the length of the abdomen without the telson ... .. *A. curtirostris.*
- II. The 6th abdominal somite is more than twice as long as the 5th: the dactyli of the 3rd and 4th thoracic legs are long and those of the 5th are of fair length and not concealed by setæ ... .. *A. cristata.*

39. *AcanthePHYRA eximia*, S. I. Smith.

*AcanthePHYRA eximia*, S. I. Smith, Rep. U. S. Fish Comm. for 1882 (1884) p. 376, and for 1885 (1886), pl. xiv. fig. 1: Wood Mason, Ann. Mag. Nat. Hist. (6) IX. 1892, p. 361, fig. 3.  
*AcanthePHYRA Edwardsii*, Spence Bate, Challenger Crust. Macrura, p. 747, pl. cxxvi. fig. 1, 1888.

The carapace and rostrum combined are at least as long as the abdomen without the telson.

Rostrum produced backwards nearly to the posterior border of the carapace as a very sharp and distinct carina, which is broadly emarginate where it is

crossed by the fine but quite distinct cervical groove. It varies in length according to sex and age, being sometimes a little shorter, sometimes a little longer than the rest of the carapace. It is high and nearly straight in its basal third or so, where it is armed dorsally with from 6 to 10 (almost always 7) teeth, and is slender and upcurved in its distal two-thirds or so, where it may either be unarmed, or more usually may be armed with one or two teeth: ventrally it is armed in rather more than its middle third with 4 distant teeth.

A ridge defines the branchial regions superiorly, and a deepish groove separates the hepatic region from the convexity of the efferent branchial canal.

The outer orbital angle is well defined but blunt, and the post-antennular spine is small: the post-antennal spine is large and obliquely salient, but is not buttressed by a long carina.

The abdominal terga from the 2nd to the 6th inclusive are sharply carinated: the keel of the 2nd tergum ends abruptly, but those of the 3rd, 4th, 5th, and 6th are produced posteriorly and end each in a sharp tooth of no great size, that of the 3rd, which is conspicuously the largest, not reaching to the middle of the 4th somite, and that of the 6th being next in size. The keel of the 4th tergum has a fine notch in its posterior fourth. The 6th abdominal somite is not half again as long as the 5th. The telson is slightly longer than the endopodite, but considerably shorter than the exopodite of the caudal swimmeret.

Eyes a little wider than their stalks, dark brown or nearly black in colour.

The antennular peduncle does not reach halfway along the antennal scale; its basal joint, which is the longest, has a small tooth at the distal end of the outer border.

The antennal scale is about two-thirds the length of the carapace without the rostrum, its outer border is broadly strengthened and ends in a small spine. The ventral border of the 2nd joint of the antennal peduncle is produced to form a stout spine, which is fringed internally with long setæ.

The external maxillipeds reach about three-quarters of the way along the antennal scale. The 2nd pair of legs, which are slightly longer and slenderer than the 1st pair, reach a little more than halfway along the antennal scale. The third pair of legs, which are the longest, reach nearly to the tip of the antennal scale. In the 3rd and 4th pair of legs the posterior border of the ischium and merus is closely spinose, the posterior border of the propodite has some fine deciduous spinelets, and the posterior border of the very short dactylus has a comb of capillary spinelets. In the 5th pair of legs the posterior border of the merus has a few small spines, the distal two-thirds of the posterior border of the propodite is fringed with a brush of setæ, and the minute dactylus is hidden in a tuft of setæ.

Colour in life crimson.



In the largest specimen the rostrum is 26 millim. long, the carapace, measured in the middle line, 29 millim., and the abdomen 66 millim.

Found here in the Arabian Sea in 457-589, 595-556, and 865 fathoms; in the Bay of Bengal in 561 and 753 fathoms, and in the Andaman Sea in 405 and 498 fathoms.

Regd. Nos.  $\frac{6756-6757}{9}$  :  $\frac{9226}{9}$  :  $\frac{9229}{9}$  :  $\frac{1443}{10}$  :  $\frac{2419}{10}$  :  $\frac{3810-3811}{10}$  :  $\frac{3816}{10}$ .

*Acanthephyra eximia* var. *brachytelsonis* (Spence Bate).

*Acanthephyra brachytelsonis*, Spence Bate, Challenger Crust. Macrura, p. 753, pl. cxvii, fig. 7: Wood-Mason, Annals and Mag. Nat. Hist. (6) VII 1891, p. 195 and (6) IX. 1892, pp. 362, 363, fig. 4.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE III. FIG. 2.

*A. brachytelsonis* ought, perhaps, not to be separated from *A. eximia*, from which it differs only in the following unreliable characters:—

The ventral border of the rostrum has only 3 teeth—two being close together at, or just abaft, the middle, and the third being about midway between these and the tip.

The basal crest of the rostrum is armed (dorsally) with from 5 to 7 (usually 6) teeth, in advance of which the dorsal border of the rostrum is usually quite smooth.

Colour in life, crimson.

In the largest perfect specimen the rostrum is 30 millim. long, the carapace 34 millim., and the abdomen 78 millim.

Found here in the Arabian Sea in 738, 740, 865, 890, 902, 912-931, 947 and 1000 fathoms; in the Bay of Bengal in 753 and 800-637 fathoms, and in the Andaman Sea in 490, 500 and 683 fathoms.

Wood-Mason considered, with some justification, that Spence Bate's *A. angusta* is, like *A. brachytelsonis*, identical with *A. eximia*.

Regd. Nos.  $\frac{8518}{6}$  :  $\frac{43}{7}$  :  $\frac{6072-6073}{9}$  :  $\frac{6080-6087}{9}$  :  $\frac{6750}{9}$  :  $\frac{8105}{9}$  :  $\frac{9227-9228}{9}$  :  $\frac{305-306}{10}$  :  $\frac{334}{10}$  :  $\frac{375-376}{10}$  :  $\frac{747}{10}$ .

40. *Acanthephyra armata*, A. M. Edw.

*Acanthephyra armata*. A. Milne Edwards, Ann. Sci. Nat., Zool., (6) XI. 1881, Art. 4, p. 12, and Rec. Fig. Crust. pl. 28, fig. 1: Spence Bate, Challenger Crust. Macrura, p. 744, pl. cxxv, fig. 2.

*Acanthephyra armata* var., Wood-Mason, Ann. Mag. Nat. Hist. (6) IX. 1892, pp. 359, 360, fig. 2.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE III. FIG. 1.

Differs from *A. eximia* in the following characters:—

The rostrum is produced as a low carina to about the middle of the gastric region, behind which it is continued as an indistinct ridge. (As in *A. eximia* it varies in length, being sometimes a good deal longer and sometimes a good



deal shorter than the rest of the carapace). Its basal moiety is nearly horizontal, its distal moiety is somewhat abruptly ascendant. Its dorsal border is smooth and entire except at the extreme proximal end where there are 4 or 5 teeth, the first 2 or 3 of which are very small: on its ventral border is a single large tooth situated near, and accenting, the point where it becomes ascendant.

The cervical groove is practically obsolete. The post-antennal spine is very salient and is continued backwards, to the end of the hepatic groove, as a sharp carina.

The abdominal terga are carinated as in *A. evimia*, the only difference being that the spines which terminate the carinae of the 4th and 5th terga are quite as large as that of the 6th and nearly as large as that of the 3rd.

The eyes are nearly black, and there is a distinct "ocellus."

The antennal scale is rather more than two-thirds the length of the carapace proper.

The thoracic legs, especially those of the last 3 pairs, are much more setose. Colour in life, crimson.

In the largest perfect specimen the length of the rostrum is 36 millim., of the carapace 51 millim., and of the abdomen 104 millim., in the smallest perfect specimen the length of the rostrum is 32 millim., of the carapace 24 millim., and of the abdomen 57 millim.

Found here in the Arabian Sea, off the S. W. coast of India, in 406 fathoms, in the Bay of Bengal in 475, and 594-225 fathoms, and in the Andaman Sea in 405 fathoms.

Regd. Nos.  $\frac{6753}{9}$  :  $\frac{9222-9223}{9}$  :  $\frac{283-284}{10}$  :  $\frac{798}{10}$  :  $\frac{3807-3809}{10}$ .

#### 41. *Acanthephyra sanguinea*, Wood-Mason.

*Acanthephyra sanguinea*, Wood-Mason, Ann. Mag. Nat. Hist., May 1892, p. 358, fig. 1.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE III. FIG. 3.

Differs from *A. evimia* in the following characters:—

The rostrum is slender and upcurved throughout, and is armed throughout its extent with distant teeth, 8 or 9 on the dorsal border, 5 or 6 on the ventral. (As in *A. evimia*, it varies in length, being usually longer but sometimes shorter than the rest of the carapace). It is continued backwards, to within a short distance of the posterior border of the carapace, as a very indistinct ridge.

The cervical groove is obsolete: no ridge defines the branchial regions superiorly: the hepatic groove is indistinct: *the post-antennal spine is minute*, being even smaller than the small post-antennular spine, and is not buttressed by any carina.

The abdomen is carinated as in *A. eximia*, but the carina of the 2nd tergum is low, and the tooth that terminates the carina of the 3rd tergum is very little larger than those of the 4th, 5th and 6th, overlapping the 4th tergum only a very short way. *The telson is longer than the exopodite of the caudal swimmeret*, and the spines on the distal two-thirds of its lateral borders are very conspicuous.

The antennal scale is more than two-thirds the length of the carapace.

The thoracic appendages have nearly the same proportions and structure as in *A. eximia*, except that *the 5th pair of legs are very decidedly longer than the 3rd and 4th.*

Colour in life deep crimson.

In the largest specimen the length of the rostrum is 25 millim., of the carapace 22 millim., of the abdomen 64 millim.

Arabian Sea in 295-360, 445-386, 480, 738, 865, 902, 937, and 1091 fathoms, Bay of Bengal in 1748 fathoms, Andaman Sea 194, 370-419, 409, and 640 fathoms.

This species is very like *A. purpurea* A. M. Edw. (= *A. agassizii* Smith), from the Atlantic, but it is at once distinguished by the minute post-antennal ("branchiostegal") spine.

$$\text{Regd. Nos. } \frac{45}{7} : \frac{526}{7} \text{ (Types of the species) : } \frac{6758}{9} : \frac{9225}{9} : \frac{9230}{9} : \frac{1724}{10} : \frac{2577-2579}{10} : \\ \frac{2606}{10} : \frac{3406}{10} : \frac{3439}{10} : \frac{3855}{10} : \frac{3866}{10}.$$

#### 42. *Acanthephyra microphthalmus*, S. I. Smith.

*Acanthephyra microphthalmus*, S. I. Smith, Proc. U. S. Nat. Mus. VII. 1884 (1885), p. 502, and Rep. U. S. Fish. Comm. for 1885 (1886) [p. 64], pl. xiii. fig. 3: Wood-Mason, Ann. Mag. Nat. Hist. (6) IX. 1892. p. 361.

*Acanthephyra longidens*, Spence Bate, Challenger Crust. Macrura, p. 735, pl. cxxiv. fig. 4.

Distinguished from *A. eximia* by the following characters:—

The rostrum, which is not produced to the posterior border of the carapace either as a crest or as an indistinct ridge, is about as long as the rest of the carapace: its basal fourth is deep and slightly ascendant, its distal three-fourths is slender and strongly upcurved: dorsally it is armed along its basal crest only with from 3 to 5 little teeth, beyond which it is quite smooth, ventrally it is armed in its distal two-thirds with 6 or 7 equidistant teeth.

No ridge defines the branchial regions superiorly: the hepatic groove is oblique and very fine: the post-antennal spine is very small, hardly larger than the post-antennular spine.

The 2nd abdominal tergum is not carinated, but the 3rd, 4th, 5th, and 6th are—the 3rd and 4th very strongly so, the carinae of these two terga together forming a compressed hump. The carina of the 3rd tergum is the only one that is distinctly produced, it being prolonged posteriorly to form a long slender

hook-like spine the tip of which reaches to the posterior border of the 4th tergum. The 6th abdominal somite is quite half as long again as the 5th, and the telson is at least as long as the exopodite of the caudal swimmeret.

The eyes are much narrower than the eyestalks and are pale brown in colour.

The antennular peduncle does not reach a third of the way along the antennal scale; its basal joint is not so deeply concave dorsally, and the "scale" at the base of the outer border of this joint reaches beyond the joint.

The antennal scale is more than two-thirds the length of the carapace proper: the tooth at the far end of the outer border of the 2nd joint of the peduncle is small and has no fringe of setæ.

The thoracic appendages have the same structure and much the same proportions as in *A. eximia*, but the third pair of legs, which when pronated reach only just halfway along the antennal scale, are a little shorter than the 4th and 5th pairs.

Colour in life deep crimson.

In the largest specimen the length of the rostrum is 22 millim., of the carapace 23 millim., of the abdomen 61 millim.

Found here in the Bay of Bengal in 1748 fathoms.

Regd. No.  $\frac{6754-6755}{9}$ .

### 43. *AcanthePHYra curtirostris*, Wood-Mason.

*AcanthePHYra curtirostris*, Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 195, and May 1892, pp. 364, 365, fig. 5; Faxon, Mem. Mus. Comp. Zool., XVIII. 1895, p. 164, pl. xliii. figs. 2-5.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE III. FIG. 4.

Differs from *A. eximia* in the following characters:—

The carapace and rostrum are both very short, their combined length being only half that of the abdomen without the telson: the carapace is not distinctly carinated behind the gastric region.

The rostrum has the form of a very thin and high, obliquely ascendant frontal crest, the acuminate peak of which does not surpass, often does not reach, the end of the antennular peduncle: its dorsal border is 7-9-serrate, and there is a single spine in the middle of the semi-perpendicular ventral border.

Cervical groove fine, but visible: post-antennal spine large and produced backwards to the end of the hepatic groove as a sharp carina.

Abdominal terga carinated as in *A. eximia*, except that the tooth terminating the carina of the 6th tergum is hardly defined, and that the tooth terminating the carina of the 3rd tergum, though larger than those of the 4th and 5th terga,

is small. The 6th abdominal somite is more than half again as long as the 5th. The telson is longer than the exopodite of the caudal swimmerets and its lateral spines are conspicuous.

The inner angle of the eyestalk is produced to form a spine that embraces the cornea.

The antennal scale is nearly three-fourths the length of the carapace proper. The thoracic legs are similar in structure and proportions to those of *A. eximia*, except that the 3rd pair are not longer than the 4th and 5th pairs.

Colour in life crimson.

In an egg-laden female the rostrum is 6 millim. long, the carapace 16 millim. long, and the abdomen 54 millim.

From the Arabian Sea in 937, 1000, and 1043 fathoms, the Bay of Bengal in 364, 840, and 869-913 fathoms, and the Andaman Sea in 922 fathoms.

Regd. Nos.  $\frac{6089}{9} : \frac{6751-6752}{9}$  (Types of the species) :  $\frac{529}{7} : \frac{6088}{9} : \frac{6090}{9} : \frac{811}{10} : \frac{3437}{10} : \frac{3441-3442}{10}$ .

#### 44. *Acanthephyra cristata*, Faxon.

*Acanthephyra cristata*, Faxon, Bull. Mus. Comp. Zool. XXIV. 1893, p. 206, and Mem. Mus. Comp. Zool., XVIII. 1895, p. 162, pl. xliii. figs. 1 *a-b*: Anderson, Journ. As. Soc. Bengal, LXV. pt. 2, 1896, p. 94.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XXV. FIG. 2.

The rostrum and carapace combined are not nearly as long as the abdomen without the telson.

The rostrum is about three-fourths the length of the rest of the carapace: its basal portion forms a very prominent crest which falls away in the after half of the gastric region and gradually disappears a short distance in front of the posterior border of the carapace: it is armed dorsally on the basal crest with about 7 rather close-set teeth and in front of the crest with 4 distant teeth, and ventrally with 4 distant teeth.

From the post-antennular spine a sinuous ridge runs backwards and almost meets the ridge that defines the upper limit of the branchial region. The post-antennular spine is salient but is not buttressed by any long carina. The cervical groove is obsolete.

The only abdominal terga that are distinctly carinated are the 3rd and 4th: the carina of the 3rd ends in a spine of medium size, that of the 4th in a much smaller one. *The 6th abdominal somite is more than twice as long as the 5th.* The telson is as long as the exopodite of the caudal swimmeret.

The distal end of the outer border of the basal joint of the antennular peduncle is not produced, and the scale at the basal end of that border is hardly half the length of the joint.



The antennal scale is more than three-fourths the length of the carapace proper. The spine at the far end of the outer border of the 2nd joint of the antennal peduncle has no fringe of setæ.

The external maxillipeds reach about two-thirds of the way, the 2nd pair of legs hardly a third of the way, the 4th pair of legs nearly to the tip, of the antennal scale.

Except as regards the palm, the 2nd pair of legs are not slenderer than the 1st.

The last 3 pairs of legs are slender and the 4th pair are a little longer than the 3rd and a good deal longer than the 5th. In the 3rd and 4th pair the posterior border of the ischium and merus is spinose, and the dactylus is a long and slender joint: in the 5th pair the posterior border of the merus is spinose, and the dactylus, though much shorter than those of the 3rd and 4th pairs, is of fair length and not at all hidden in setæ.

In our single specimen, which was dredged in the Arabian Sea in 890 fathoms, the length of the rostrum is 11 millim., of the carapace 14 millim., and of the abdomen 43 millim.

Colour in life crimson.

Regd. No.  $\frac{4794}{7}$ .

#### EPHYRINA, S. I. Smith.

*Ephyrina*, S. I. Smith, Proc. U. S. Nat. Mus. VII. 1884 (1885), p. 506, and Report U. S. Fish. Comm. for 1885 (1886) [p. 69].

*Tropiocaris* (part) Spence Bate, Challenger Crust. Macrura, p. 834.

Body moderately compressed. Rostrum compressed and high, but short. Carapace smooth, not articulating with the abdomen by any special processes: antennular and branchiostegal spines are present, the former being more or less coincident with the orbital angle.

Abdomen little or not at all carinated: the pleura wide: the telson long and acute.

Antennules and antennæ as in *Acantheephyra*, as also are the exopodites of the thoracic appendages.

The terminal joint of the 2nd maxillipeds although it articulates obliquely, is a distinct and independent dactylus. External maxillipeds stout, pediform, their 2nd segment (basis-ischium-merus) arched outwards.

Thoracic legs not elongate, the longest of them being not much longer than the carapace and rostrum combined: *some or all of them have the ischium and merus broad, thin, and leaflike*: the first two pairs end in well formed chelæ.

Abdominal appendages as in *Hoplophorus*.



The branchial formula is identical with that of *Acanthephyra*, and is as follows:—

Somites and their Appendages.	Podobranchiæ.	Arthrobranchiæ.	Pleurobranchiæ.	
VII	(ep.)	0	0	= ep.
VIII	1 (ep.)	0	0	= 1 + ep.
IX	(ep.)	2	0	= 2 + ep.
X	(ep.)	1	1	= 2 + ep.
XI	(ep.)	1	1	= 2 + ep.
XII	(ep.)	1	1	= 2 + ep.
XIII	0	1	1	= 2
XIV	0	0	1	= 1
Total	1 + 6 ep.	6	5	= 12 + 6 ep.

It is doubtful, as Faxon suggests, whether *Ephyrina* should be separated from *Acanthephyra*: *Acanthephyra curtirostris* and *cristata* link the two genera together.

#### 45. *Ephyrina Hoskynii*, Wood-Mason.

*Ephyrina Hoskynii*, Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 194: Caullery, "Caudan" Crust. in Ann. de l'Univ. Lyon, 1896, p. 376.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE LII. FIG. 3.

The rostrum and carapace combined are a little over half the length of the abdomen without the telson.

The rostrum has the form of a high thin frontal crest, not reaching to the end of the eyestalks, terminating anteriorly in a sinuous vertical margin, and having both its margins trenchant: posteriorly it is produced a short way behind the gastric region as a moderate carina.

The outer orbital angle coincides with the post-antennular spine, which is hardly so long as the post-antennal spine—the latter being a true branchiostegal spine situated at the antero-lateral angle of the carapace. A sinuous ridge runs from the orbital notch nearly to the posterior border of the carapace, and an oblique offshoot of this ridge defines the hepatic groove posteriorly.

None of the abdominal terga are either carinated or produced posteriorly as spines, and the first 3 abdominal somites are only moderately compressed: the 6th somite is nearly twice as long as the 5th. The telson is shorter than the exopodite of the caudal swimmeret.

Eyes well pigmented, not wider than their stalks. The antennular peduncle does not reach halfway along the antennal scale, the basal joint is the longest and has a short "scale" at the base of its outer border. The antennal scale is hardly two-thirds the length of the carapace proper, its outer edge is thickened

and ends in a small spine: the tooth at the end of the ventral border of the 2nd joint of the antennal peduncle is very small.

The external maxillipeds, which have broadened and compressed, but not foliaceous, joints, reach slightly beyond the tip of the antennal scale.

All the thoracic legs have the merus and ischium thin, compressed and foliaceous: the 2nd pair, which have the wrist palm and fingers slightly longer than those of the 1st pair, reach to the tip of the antennal scale. The three last pairs of legs are of about equal length—the anterior (3rd) pair reaching about a dactylus length beyond the antennal scale: in the 3rd and 4th pair the dactylus is long slender and slightly curved, and the posterior border of the ischium and merus is spinose: in the 5th pair the dactylus is short and a good deal hidden in setæ, and the posterior border of the ischium and merus is entire.

Colour in life, dark red.

In the largest specimen the length of the combined carapace and rostrum is 28 millim., and that of the abdomen is 61 millim.

Arabian Sea, in the neighbourhood of the Laccadives and northwards, in 487, 740, and 890 fathoms: Bay of Bengal, off Ceylon, in 800–637 fathoms.

Regd. Nos.  $\frac{6141}{9}$  (Type of the species):  $\frac{374}{10}$ :  $\frac{750}{10}$ :  $\frac{3818}{10}$ .

#### Family *Nematocarcinidæ*, Sp. Bate.

Spence Bate, Challenger Crust. Macrura, pp. 481, 927: Stebbing, Hist., Crust. p. 249.

Rostrum well developed. Antennular scale present: two extremely long antennular flagella. Antennal scale long and narrow.

Mandible deeply cleft into strong incisor and molar processes and bearing a stout 3-jointed palp. The coxa and basis of the 1st and 2nd maxillæ and of the 1st maxillipeds are well developed, the coxa of the 2nd maxillæ receding. The exopodite of the 1st maxillipeds ends in the usual flagellum. The terminal joint of the 2nd maxillipeds lies obliquely along the distal part of the inner border of the propodite and looks like a complementary piece of that joint. External maxillipeds long, pediform.

All the legs are slender and—especially the last 3 or 4 pairs—of wonderful length: the first 2 pairs end in small but well formed chelæ, the carpus of the 2nd pair being undivided.

All the thoracic appendages, except the last pair of legs, have slender exopodites.

The *Nematocarcinidæ* in a logical system should not be separated as a distinct family, for they are merely *Pandalidæ* in which the first four pairs of thoracic legs have delicate exopodites, and they might be united with the latter family.

## NEMATOCARCINUS, A. M. Edw.

*Nematocarcinus*, A. Milne Edwards, Ann. Sci. Nat., Zool., (6) XI. 1881, Art. 4, p. 14.

*Eumiersia*, S. I. Smith, Bull. Mus. Comp. Zool. X. 1882-83, p. 77. (*ipso teste*).

*Nematocarcinus* and *Stochasmus*, Spence Bate, Challenger Crust. Macrura, pp. 800, 822.

Body moderately compressed. Rostrum long or moderate, dorsally serrated, the teeth sometimes articulated. Carapace smooth, the anterior border with a post-antennular and a true branchiostegal spine.

Abdomen smooth, the 3rd tergum usually with a strongly convex posterior border, the pleura thin and wide. Telson long, tapering, with well developed spines at tip.

Eyes large and well pigmented. Antennular peduncle short, the basal joint dorsally concave for the eye and with a sharp scale at the base of the outer border: the antennular flagella are of very great length, the outer one is a little thickened at base. Antennal scale long and narrow, with truncate tip: the outer margin broadly thickened, and ending in a little spine.

Scaphognathite acutely produced posteriorly. External maxillipeds shorter than any of the legs.

The legs are remarkable for the enormous length of the ischium merus and carpus—particularly of the carpus—and for the curious thickened and splice-like articulation between the ischium and merus. The first 2 pairs end in small and slender chelæ, which are a good deal concealed by tufts of setæ: the 2nd pair are a good deal longer than the 1st. The last 3 pairs, which are of nearly equal length, are longer than the 2nd pair, and end in slender dactyli which are more or less concealed in a brush of setæ.

The abdominal appendages are all biramous: in the 2nd-5th pairs the endopodite has the usual internal appendix at its base, the 2nd pair in the male having an additional appendix.

The last 3 thoracic sterna are strongly carinated fore-and-aft on either side in the male, but in the female only the ante-penultimate sternum is distinctly so carinated.

The branchial formula is as follows :—

Somites and their Appendages.	Podobranchiæ.	Arthrobranchiæ.	Pleurobranchiæ.	
VII	(ep.)	0	0	= ep.
VIII	1 (ep.)	0	0	= 1+ep.
IX	(ep.)	2	0	= 2+ep.
X	(ep.)	1	1	= 2+ep.
XI	(ep.)	1	1	= 2+ep.
XII	(ep.)	1	1	= 2+ep.
XIII	(ep.)	1	1	= 2+ep.
XIV	0	0	1	= 1
Total	1+7 ep.	6	5	= 12+7 ep.

The epipodites are small and do not ascend between the gill-plumes.

The eggs are small and numerous.

The species of this genus undoubtedly belong to the Necton. Spence Bate has described 15 species, which, it seems to me, may be reduced to 6 or 7.

*Key to the Indian species of Nematocarcinus.*

- I. Rostrum about two-thirds the length of the rest of the carapace measured in the middle line, and with its single ventral tooth placed some little way behind the tip:—
- |  |     |     |                             |
|--|-----|-----|-----------------------------|
| 1. Rostrum with about 22 dorsal teeth    | ... | ... | ... <i>N. tenuipes.</i>     |
| 2. Rostrum with from 7 to 9 dorsal teeth | ... | ... | ... <i>N. tenuirostris.</i> |
- II. Rostrum a third or less the length of the rest of the carapace, and with its single ventral tooth placed at the tip:—
- |   |     |     |                              |
|---|-----|-----|------------------------------|
| 1. In the 1st pair of thoracic legs the chelæ and not more than a third of the carpus lie beyond the antennal scale:—   |     |     |                              |
| i. Rostrum with about 15 small close-set dorsal teeth   | ... | ... | ... <i>N. cursor.</i>        |
| ii. Rostrum with about 9 dorsal teeth   | ... | ... | ... <i>N. paucidentatus.</i> |
| 2. In the 1st pair of legs the chelæ and more than two-thirds of the carpus lie beyond the antennal scale: rostrum with about 20 small close-set dorsal teeth |     |     |                              |
|   | ... | ... | ... <i>N. gracilis.</i>      |

46. *Nematocarcinus tenuipes*, Spence Bate.

*Nematocarcinus tenuipes*, Spence Bate, Challenger Crust. Macrura, p. 812, pl. cxxxii. fig. 6: Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 197.

? *Nematocarcinus productus* and *intermedius*, id. ib., pp. 810, 821, pl. cxxxii. figs. 5, 13.

It is doubtful whether this species is distinct from *N. ensifer* S. I. Smith (Bull. Mns. Comp. Zool. X. 1882-83, p. 77, pl. xiii. figs. 1-9 and in Rep. U. S. Fish. Comm. for 1882 (1884), p. 368, pl. vii. fig. 1 and for 1885 (1886), pl. xvii. fig. 2, which occurs on both sides—American and European—of the North Atlantic, in the Mediterranean, and off the Pacific coast of Central America.

The rostrum is about two-thirds the length of the rest of the carapace measured in the middle line, is continued nearly to the after limit of the gastric region as a faint carina, and is gently ascendant: it is armed dorsally with about 22 teeth, most of which are articulated and the posterior 10 or 12 are close-set, and ventrally with a single tooth placed not far from the tip.

The gastric region is incompletely defined by fine grooves, the branchial regions are defined dorsally by a fine low ridge, and there is a dimple in the hepatic region. The post-antennular and branchiostegal spines are sharp, the former being the larger.

None of the abdominal terga are distinctly carinated, but the 3rd has its posterior border strongly and subacutely produced in the middle line. The 6th somite is twice as long as the 5th. The telson, including its strong terminal spines, is as long as the exopodite of the caudal fan.

Eyes reniform, of good size. The antennular peduncle reaches a little more



than halfway along the antennal scale, its "stylocerite" ends very sharply. The antennal scale is about two-thirds the length of the carapace proper and hardly reaches beyond the rostrum: there is a small tooth behind the base of its outer border, on the 2nd joint of the peduncle.

The external maxillipeds reach about three-fourths of the way along the antennal scale: their 2nd joint (basis-ischium-merus) is broad at base and gradually diminishes anteriorly, the outer edge of its ventral surface having a series of small deciduous spines: their terminal joint is narrowly spoon-shaped.

The 1st pair of legs have smooth joints, and reach beyond the antennal scale by their chelæ and tip of carpus only.

The 2nd pair have a spine on the posterior border of the ischium and about 5 spines along the same border of the merus: they reach beyond the antennal scale by their chelæ and the whole of their elongate carpus, and their total length is equal to the distance between the tip of the rostrum and the posterior border of the 3rd abdominal tergum.

The 3rd, 4th and 5th pair have some small and distant spines along the posterior border of the merus: they reach beyond the antennal scale by the tip of the merus the very elongate carpus and the two short terminal joints, and their total individual length is not quite twice that of the carapace and rostrum combined, and is less, by more than the length of the rostrum, than the total length of the body.

Colour in life, bright orange.

In an egg-laden female the length of the rostrum is 17 millim., of the carapace measured in the middle line 24.5 millim., of the abdomen 68 millim., of the longest leg 80 millim.

Arabian Sea in 824, 836, 937, 1000 and 1200 fathoms: Bay of Bengal in 1310 fathoms.

Regd. Nos.  $\frac{6093-6098}{9}$  :  $\frac{8667-8669}{9}$  :  $\frac{9291-9300}{9}$  :  $\frac{2420}{10}$  :  $\frac{2424}{10}$  :  $\frac{3438}{10}$ .

#### 47. *Nematocarcinus tenuirostris*, Spence Bate.

*Nematocarcinus tenuirostris*, Spence Bate, Challenger Crust. Macrura, p. 817, pl. cxxxii, fig. 10: Alcock, Ann. Mag. Nat. Hist., March 1894, p. 226.

Except that the legs are very much longer, this species closely resembles *N. tenuipes*, from which, so far as can be judged by imperfect specimens, it differs only in the following characters:—

The rostrum, which is of the same shape and length (about  $\frac{2}{3}$ rd the length of the rest of the carapace) and has a similar ventral spine placed not far from the tip, is armed dorsally with only from 7 to 9 teeth, of which the posterior 3 or 4 are close together and the others are separated from one another by intervals of increasing width: its gastric carina is sharp and distinct.



The chelæ and from one-fourth to nearly one-half the elongate carpus of the 1st pair of legs lie beyond the antennal scale.

The other legs would seem to be very much longer, for the combined merus and carpus alone of one of the last 3 pairs is nearly as long as the whole body from the tip of the rostrum to the tip of the telson.

Colour in life, bright orange-pink.

In our largest specimen the length of the rostrum is 17 millim., of the carapace 26 millim., of the abdomen 74 millim., and the length of the merus carpus and two short terminal joints of one of the monodactylous legs is 118 millim.

Gulf of Manár in 597 fathoms: Bay of Bengal, close to the Andaman shore, in 561 and 669 fathoms.

Regd. Nos.  $\frac{3174}{9} : \frac{6851}{9} : \frac{3440}{10}$ .

#### 48. *Nematocarcinus cursor*, A. M. Edw.

*Nematocarcinus cursor*, A. Milne Edwards, Ann. Sci. Nat., Zool., (6) XI. 1881, Art. 4, p. 14 and Rec. Fig. Crust. pl. 24: S. I. Smith, in Rep. U. S. Fish. Comm. for 1885 (1886), Albatross Crust., p. 61, pl. xvii. figs. 1, 1a. A. Agassiz, Bull. Mus. Comp. Zool. XV. 1888, p. 46.

? *Nematocarcinus undulatipes*, Spence Bate, Challenger Crust. Macrura, p. 801, pl. cxxx.

Differs from *N. tenuipes* in the following characters:—

The rostrum is one-third, or even less, the length of the rest of the carapace measured in the middle line, is gently ascendant, and is armed dorsally with 13–15 (usually 15) small close-set articulated teeth and ventrally with a single spine placed immediately beneath the tip: it is continued as a distinct carina almost to the after limit of the gastric region.

At least two-thirds of the antennal scale lies beyond the tip of the rostrum.

The third abdominal tergum has its posterior border less decidedly convex.

The legs are similar in form and armature to those of *N. tenuipes*, but differ (1) in being all, except the 1st pair, very much longer, and (2) in having small distant spines on both borders of the last three pairs.

The 1st pair of legs are but little longer than those of *N. tenuipes*, only the chelæ and a small part—a third or less—of the carpus lying beyond the antennal scale.

The 2nd pair are nearly as long as the distance between the tip of the rostrum and the anterior border of the telson: not only the carpus and chelæ, but also part of the merus, lie beyond the antennal scale.

The last three pairs are all considerably longer than the entire body, not only the carpus and two terminal joints, but also about a third of the merus, lying beyond the antennal scale.

Colour in life, transparent blood red.

In an egg-laden female the length of the rostrum is 6 millim., of the carapace 18 millim., of the abdomen 51 millim., of the longest leg 84 millim.

Arabian Sea in 609-620 and 675 fathoms, Gulf of Manár in 406 fathoms, Bay of Bengal in 240, 270 and 272 fathoms.

Regd. Nos.  $\frac{6265-6268}{9}$  :  $\frac{6273-6276}{9}$  :  $\frac{6278-6281}{9}$  :  $\frac{6841-6847}{9}$  :  $\frac{8664-8666}{9}$  :  $\frac{282}{10}$  :  $\frac{1165}{10}$  :  $\frac{1741-1743}{10}$  :  $\frac{3891}{10}$ .

*Nematocarcinus cursor* var. *paucidentatus*, Spence Bate.

*Nematocarcinus paucidentatus*, Spence Bate, Challenger Crust. Macrura, p. 816, pl. cxxxii. fig. 9.

Only differs from *N. cursor* in having but 7 to 9 (usually 9) teeth on the dorsal border of the rostrum.

Colour in life transparent blood-red, or pink: eggs light blue.

In an egg-laden female the length of the rostrum is 6 millim., of the carapace 20 millim., of the abdomen 54 millim., of the longest leg 95 millim.

Andaman Sea, in 188-220, 265, 271, 405 and 500 fathoms: Bay of Bengal, near the Andaman shore, in 561 fathoms, and off Ceylon (west coast) 597 fathoms.

Regd. Nos.  $\frac{8516}{6}$  :  $\frac{8578}{6}$  :  $\frac{3118-3120}{9}$  :  $\frac{3168}{9}$  :  $\frac{6848-6850}{9}$  :  $\frac{1448-1452}{10}$ .

49. *Nematocarcinus gracilis*, Spence Bate.

*Nematocarcinus gracilis*, Spence Bate, Challenger Crust. Macrura, p. 815, pl. cxxxii. fig. 8.

Differs from *N. tenuipes* in the following characters:—

The rostrum is about a third the length of the rest of the carapace measured in the middle line: it is horizontal, often with a slight distal declivity, and is armed dorsally with from 16 to 22 (usually 20) small close-set articulated teeth, and ventrally with a single tooth placed immediately beneath the obliquely-truncate tip: it is continued nearly to the after limit of the gastric region as a distinct carina.

The posterior border of the 3rd abdominal tergum is not so strongly convex.

More than two-thirds of the antennal scale lies in advance of the tip of the rostrum.

The legs only differ in being all (*including* those of the 1st pair) very much longer, and in having some small and distant spines on both borders of the very elongate merus of the last three pairs.

The 1st pair of legs are as long as the distance between the tip of the rostrum and the anterior border of the 3rd abdominal tergum: not only their chelæ, but more than two-thirds of their elongate carpus lie beyond the antennal scale.

The 2nd pair are nearly as long as the entire body, the chelæ and carpus and more than half the merus lying in front of the antennal scale.

The last three pairs are very much longer than the entire body, the two short terminal joints and the elongate carpus and two-thirds of the elongate merus lying in front of the antennal scale.

Colour in life red.

In an egg-laden female the length of the rostrum is 8 millim., of the carapace 23 millim., of the abdomen 63 millim., of the longest leg 130 millim.

Arabian Sea, in the neighbourhood of the Laccadives and south-eastwards, in 459, 636, and 705 fathoms.

This species may perhaps be only a variety of *N. cursor*, from which it only differs (1) in having more teeth on the dorsal edge of the rostrum, and (2) in the greater length of the legs, especially of those of the 1st pair.

Regd. Nos.  $\frac{44}{7} : \frac{9284-9290}{9} : \frac{1453-1457}{10}$ .

#### Family *Pandalidæ*, Bate, Ortmann.

Spence Bate, Challenger Crustacea Macrura, p. 625 : Stebbing, Hist. Crust., p. 237 : Ortmann in Bronn's Thier Reich, Arthrop., p. 1128 : Caullery, Crust. "Caudan," Ann. Univ. Lyon, 1896, p. 377 : Calman, Ann. Mag. Nat. Hist. (7) 111, 1899, p. 27.

Rostrum well developed. Antennular scale present. Antennal scale long and narrow. Two antennular flagella.

Mandible deeply cleft into strong incisor and molar processes, and bearing a palp which usually consists of 3 segments. The 1st and 2nd maxillæ and the 1st maxillipeds have the coxa and basis well developed, but the coxa of the 2nd maxillæ recedes. The exopodite of the 1st maxillipeds ends in the usual flagellum. External maxillipeds pediform, stout, with or without an exopodite. The terminal segment of the 2nd maxillipeds is a narrow plate attached along all its extent to the inner border of the penultimate segment, as if it were a complemental piece of the latter segment.

The first pair of legs are slender and are usually said to be monodactylous but, as Calman has shown, they very often end in a microscopic and more or less imperfect chela. The second pair of legs are minutely chelate. The thoracic legs never have exopodites.

Eggs small and numerous.

Numerous genera of this family have been proposed, but it seems to me that they may all be resolved into the following five, and the distinctions between even these are extremely slight :—

1. *Pandalus*, Leach, with subgenera *Pandalopsis*, *Plesionika* (=also *Nothocaris*) and *Parapandalus*.

2. *Pandalina*, Calman, Ann. Mag. Nat. Hist., Jan. 1899, p. 37.
3. *Chlorotocus*, A. M. Edw.
4. *Heterocarpus*, A. M. Edw.
5. *Dorodotes*, Sp. Bate.

*Dichelopandalus*, Caullery, as Calman suggests, is probably identical with *Pandalus*.

*Key to the genera and subgenera of Pandalidæ of the Indian Necton.*

- I. The carpus of the 2nd pair of thoracic legs is multiarticulate :—
  1. Except for a post-rostral crest, the carapace is smooth :—
    - i. Eyes large, much wider than the eyestalk (PANDALUS) :—
      - a. Epipodites absent from the last pair of thoracic legs only ... .. s.g. *Plesionika*.
      - b. Epipodites absent from all the legs ... s.g. *Parapandalus*.
    - ii. Eyes very small, narrower than the eyestalk ... DORODOTES.
  2. Carapace with longitudinal carinæ, in addition to the post-rostral crest: integument very hard and rigid ... HETEROCARPUS.
- II. The carpus of the 2nd pair of legs is divided into two segments only ... CHLOROTOCUS.

PANDALUS, Leach.

*Pandalus*, Leach, Malac. Pod. Brit. pl. xl. : Milne Edwards, Hist. Nat. Crust. II. 383 : Spence Bate, Challenger Crustacea Macrura, p. 665 : Calman, Ann. Mag. Nat. Hist. (7) III. 1899, p. 29.

Body moderately compressed. Rostrum long, serrated dorsally and ventrally. Carapace smooth, its anterior border with an orbital (antennal) and a branchiostegal spine.

Abdomen smooth, the 3rd tergum usually with a convex posterior border; the pleura thin and large, those of the 2nd somite very broadly overlapping those in front and behind. Telson narrow, tapering, spiny along the dorsal edges and at tip.

Eyes large, globular: there is usually a distinct "ocellus" near the middle of their dorsal margin.

Antennular peduncle short, with a scale at the base of the outer margin of the 1st joint: antennular flagella of good length, the outer one thickened at its proximal end, especially in the male.

Antennal scale long and slender, its outer [margin broadly thickened and ending very acutely.

External maxillipeds long, pediform, stouter than [the 1st pair of legs: exopodite present or absent: the base of the epipodite forms a plate-like lobe.

First pair of legs short and slender, ending either simply or, as Messrs. Caullery and Calman have recently demonstrated, in a microscopic and imperfect chela. Second pair of legs minutely chelate with a subdivided or multiarticulate carpus.



Abdominal appendages biramous, with long protopodites : in the 1st pair the inner ramus is small, and in all behind the 1st pair the inner ramus has the usual styliform appendix at the base of the inner edge—the male having an additional appendix on the 2nd pair. The exopodite of the caudal swimmerets is divided by a transverse suture.

The branchial formula in 10 Indian and European species examined by me is as follows :—

Somites and Appendages.	Podobranchia.	Arthrobranchia.	Pleurobranchia.	
VII	(ep.)	0	0	= ep.
VIII	1 (ep.)	0	0	= 1+ep.
IX	(ep.)	2	0	= 2+ep.
X	(ep.)	1	1	= 2+ep.
XI	(ep.)	1	1	= 2+ep.
XII	(ep.)	1	1	= 2+ep.
XIII	(ep.)	1	1	= 2+ep.
XIV	0	0	1	= 1
Total	1(+7 ep.)*	6	5	= 12+7ep.

\* In one Indian species epipodites are absent from all the legs.

Owing to the numerous discrepancies in Spence Bate's treatment of the *Pandalidæ*, it is almost impossible to undertake the very necessary revision of the *Pandalus* group without an actual examination of the "Challenger" material.

From my own observations of the Indian and six of the European species I am inclined to group them into the following subgenera :—

I. Subgenus PANDALUS (Type *P. annulicornis* Leach). External maxillipeds without an exopodite. Scaphognathite having its posterior lobe acutely produced. [Rostrum armed dorsally with movable spines only. Antennular flagella of moderate length.]

With *Pandalus*, as Calman suggests, *Dichelopandalus* Caullery ("Caudan" Crust., in Ann. Univ. Lyon, 1896, p. 379) should perhaps be included.

II. Subgenus PANDALOPSIS A. M. Edw., Sp. Bate (Type *P. ampla*, Bate). As *Pandalus*, but with the antennular flagella very long, the external maxillipeds stouter, and the laminar expansion of the inner border of the ischium of the 1st pair of legs very large.

III. Subgenus PLESIONIKA, Bate (Type *P. uniproducta*, Bate). External maxillipeds with an exopodite. Posterior lobe of scaphognathite broadly rounded off. [Rostrum armed dorsally with fixed teeth and sometimes with movable teeth also.]

With *Plesionika* should also be included *Nothocaris*.

IV. Subgenus PARAPANDALUS, Borradaile (Type *P. serratifrons*, Borradaile).  
As *Plesionika*, but epipodites are absent from all the thoracic legs.

*Key to the subgenera of Pandalus of the Indian Necton.*

- |  |     |               |
|--|-----|---------------|
| I. Epipodites are present on the first four pairs of thoracic legs | ... | PLESIONIKA.   |
| II. No epipodites behind the external maxillipeds                  | ... | PARAPANDALUS. |

Subgenus PLESIONIKA, Spence Bate.

*Plesionika* and *Nothocaris*, Spence Bate, Challenger Crust. Macrura, pp. 640, 650.

External maxillipeds with an exopodite. Scaphognathite broadly rounded, not acutely produced. All the thoracic legs except the last have an epipodite. Last 3 pairs of legs long and slender.

*Synopsis of the Indian species of Plesionika.*

- I. The legs of the 2nd pair are of equal or nearly equal length. The dorsal border of the rostrum, beyond the tip of the antennular peduncle, is quite smooth:—
  1. The ventral border of the rostrum is very closely and evenly serrated: the 2nd pair of legs do not nearly reach the tips of the external maxillipeds: ocellus distinct:—
    - i. The posterior border of the 3rd abdominal tergum though convex is not acutely produced ... .. *P. (P.) martius.*
    - ii. The posterior border of the 3rd abdominal tergum is acutely produced into a sharp tooth that overlaps the next tergum ... .. *P. (P.) ensis.*
  2. The ventral border of the rostrum is armed with a series of *distant* spines: the 2nd pair of legs reach the tips of the external maxillipeds: no ocellus ... .. *P. (P.) alcocki.*
- II. The legs of the 2nd pair are conspicuously unequal in length: the dorsal border of the rostrum is spinose in all its extent:—
  1. Rostrum longer than the carapace: telson as long as the 6th abdominal somite: 5th pair of legs the longest of all: 1st pair of legs much longer than the external maxillipeds: ocellus particularly distinct ... .. *P. (P.) ocellus.*
  2. Rostrum shorter than the carapace: telson as long as the 5th and 6th abdominal somites combined: one of the legs of the 2nd pair is the longest of all: external maxillipeds much longer than the 1st pair of legs: no ocellus ... .. *P. (P.) bifurca.*

In addition to the above, the young of a species that, I think, must be *P. unidens* Spence Bate, has been found in Indian Seas. It is easily recognized by the *median carination of the posterior half of the 3rd abdominal tergum*, and by the *isolated dorsal spine just behind the tip of the rostrum*.

50. *Pandalus (Plesionika) martius*, A. M. Edw.

*Pandalus martius*, A. Milne Edwards, Recueil de Figures de Crustacés Nouveaux, pl. 18 (1883) : Wood-Mason, Ann. Mag. Nat. Hist. (6) IX. 1892, p. 369 : Adensamer, Denk. Kais. Akad. Wien, LXV. 1898, p. 624.

? *Plesionika semilævis*, Spence Bate, Challenger Crustacea Macrura, p. 644, pl. cxiii. fig. 3 (and ? *P. brevirostris*, id. *ibid.*, p. 650).

*Plesionika martia*, Caullery, Ann. L'Univ. Lyon, 1896, "Caudan" Crust., p. 378, pl. xv. figs. 1-6.

Rostrum from  $1\frac{2}{3}$  to nearly  $2\frac{1}{2}$  times the length of the rest of the carapace measured in the middle line; its basal portion, as far as the end of the antennular peduncle, is arched and is armed dorsally only with from 5 to 8—usually 8—teeth, five or six of which form a series that gradually increase in size from behind forwards while the anterior two are usually somewhat isolated; beyond the antennular peduncle the rostrum is straight, ascendant, and quite smooth dorsally, but ventrally it is *very closely finely and evenly serrated*, the teeth being a good deal concealed in a short fringe of cilia. All the teeth are fixed. The gastric crest of the rostrum is continued to near the middle of the carapace, which is otherwise quite smooth.

The posterior border of the 3rd abdominal tergum, though convex, is not acutely produced. The 6th abdominal tergum is as long as the telson, and twice as long as the 5th. The telson, though as long as the endopodite of the tail-fan, is shorter than the exopodite.

The ocellus is distinct but not independent.

The antennular peduncle does not reach halfway along the antennal scale, its basal joint is much the longest: the unbroken antennular flagella are very much longer than the combined carapace and rostrum.

The antennal scale is not very much shorter than the carapace proper, and is narrow and tapering, but with the tip truncated. There is a strong spine on the outer and lower aspect of the 2nd joint of the antennal peduncle.

The external maxillipeds, which are a little longer and stouter than the 1st pair of thoracic legs, reach a short way beyond the tip of the antennal scale: they have a well-developed exopodite.

All the legs are slender: the last 3 pairs are very much longer than the first 2 pairs, the fifth pair, which are—especially in the female—the longest of all, being nearly twice as long as the 1st pair. The 1st pair have all their joints slender, and end in a minute dactylus, at the base of which is a microscopic very short fixed finger: the minute and imperfect chela thus formed is a good deal hidden by scattered setæ. The 2nd pair, which are symmetrical and reach a little beyond the far end of the penultimate joint of the external maxillipeds, have a multiarticulate carpus the end of which bears a whorl of setæ, and a minute chela which also carries some tufts of setæ. In the 3rd, 4th, and 5th pairs, the merus, carpus, and propodite are very long and slender, and the dactylus is short; the posterior border of the merus is armed with slender distant spines,

which are least distinct on the 5th pair, and the propodite is tipped with rather lank tufts of setæ.

In two egg-laden females and two males the measurements are as follows, in the median line :—

		Free portion of rostrum.	Carapace proper.	Abdomen.
Female	{ 1	41 millim.	18 millim.	56 millim.
	{ 2	41 "	22 "	66 "
Male	{ 1	36 "	16.5 "	51 "
	{ 2	39 "	15 "	50 "

Colour in life pink, eggs light blue.

Dredged in plenty in the Andaman Sea, at 194, 188 to 220, 271, and 405 fathoms; in the Bay of Bengal, off Ceylon, at 224 to 284 fathoms; and in the Arabian Sea, off the Travancore coast and C. Comorin, at 142 to 400 and 430 fathoms.

Our specimens are identical with specimens dredged in the Mediterranean and presented by Professor Giglioli of the Florence Museum.

Regd. Nos.  $\frac{8576}{6} : \frac{8579}{6} : \frac{3121}{9} : \frac{6801-6820}{9} : \frac{9301-9303}{9} : \frac{1420-1442}{10} : \frac{1444-1445}{10} : \frac{2106-2107}{10} :$   
 $\frac{2588}{10} : \frac{3400}{10} .$

### 51. *Pandalus (Plesionika) ensis*, A. M. Edw.

*Acanthephyra ensis*, A. Milne Edwards, Ann. Sci. Nat., Zool., (6) XI. 1881, Art. 4, p. 14.

*Pandalus ensis*, A. Milne Edwards, Recueil Fig. Crust. pl. 35.

? *Plesionika uniproducta*, Spence Bate, Challenger Crust. Macrura, p. 641, pl. cxiii. fig. 1.

Very similar to *P. martius*, from which it differs only in the following characters :—

At the proximal end of the rostrum there are 5 or 6 teeth, three or four close together, two isolated anteriorly.

The posterior border of the 3rd abdominal tergum is acutely produced in the middle line to form a spine. The 6th abdominal tergum is longer than the telson, and is more than twice as long as the 5th.

Though the last 3 pairs of legs are longer than the first 2 pairs, yet they are not so much longer, the 5th pair being nothing like twice the length of the 1st pair. The setæ at the end of the carpus, and on the chelæ of the 2nd pair of legs are much finer and less conspicuous.

In the Investigator collection are 2 specimens, from the Andaman Sea, 185 fathoms.



In the larger of these, an egg-laden female, the rostrum (which has the tip broken off) is 36 millim. long, the carapace 17 millim., and the abdomen 51 millim., measured in the middle line.

Regd. No.  $\frac{2171}{10}$ .

52. ? *Pandalus (Plesionika) unidens*, Spence Bate.

? *Plesionika unidens*, Spence Bate, Challenger Crustacea Macrura, p. 648, pl. cxiii. fig. 4.  
*Plesionika affinis*, Anderson, Ann. Mag. Nat. Hist., April 1899, p. 285.

Two young specimens, believed to be this species, were taken in the Andaman Sea, in 172–303 fathoms.

The posterior half of the 3rd abdominal tergum is carinated in the middle line. The rostrum, which is serrated dorsally at its proximal end only and is more or less serrated ventrally, has a characteristic spine near the tip, on the dorsal border.

Regd. No.  $\frac{3166-3167}{10}$ .

53. *Pandalus (Plesionika) alcocki*, A. R. S. Anderson.

*Pandalus alcocki*, Anderson, Journ. Asiatic Soc. Bengal, Vol. LXV. pt. 2, 1896, p. 92.  
 ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE LII. FIG. 2 ♂, FIG. 4 ♀.

Differs from *P. martius* only in the following characters:—

The rostrum is of the same general shape and nearly as long: it is armed dorsally, at its basal end, with (usually) 5 teeth, three (or four) of which are movable and very small and stand close together on the gastric crest, with two large isolated ones just in front of them: ventrally it is armed throughout, beyond the antennular peduncle, with a series of distant teeth not concealed by setæ—to the number of from 4 to 8.

The 6th abdominal tergum is not quite twice as long as the 5th. The telson is shorter than the endopodite of the caudal fan.

There is no distinct ocellus on the dorsal margin of the eye.

The first pair of legs are not shorter than the external maxillipeds. The second pair in the male alone are very slightly unequal in length: one of them reaches almost to, the other very slightly beyond, the tips of the external maxillipeds; their chelæ have no conspicuous tufts of setæ: in the female both of them reach just beyond the tip of the antennal scale.

In the last 3 pairs of legs the spines on the posterior border of the merus are reduced, respectively, to 4, 2 or 3, and 2, placed at the distal end only: in the female the dactylus of these legs is short, very weak, and almost completely hidden in a tuft of setæ. Colour in life, red.

In an egg-laden female, taken at random, the length of the rostrum is 3.2 millim., of the carapace 16.5 millim., and of the abdomen 4.8 millim., measured in the middle line.

Arabian Sea, off the south and south-west coast of India, 360, 406, and 597 fathoms: Bay of Bengal, near the Andamans, 561 fathoms: Andaman Sea, 271, 405, 490, and 500 fathoms.

Regd. Nos.  $\frac{6821}{9} : \frac{1838}{10}$  (Types of the species) :  $\frac{8519}{6} : \frac{8577}{6} : \frac{46}{7} : \frac{4793}{7} : \frac{3123}{9} : \frac{3169}{9} :$   
 $\frac{6822}{9} : \frac{335-361}{10} : \frac{1446-1447}{10} : \frac{1945-1948}{10} : \frac{1965-1967}{10}.$

#### 54. ? *Pandalus (Plesionika) ocellus*, Spence Bate.

? *Nothocaris ocellus*, Spence Bate, Challenger Crust. Macrura, p. 657, pl. cxiv. fig. 3.

Distinguished from *P. martius* by the following characters:—

The rostrum is shorter: dorsally it is armed along its whole extent with spines, those on the gastric crest and at the base being close together, those beyond the eyes being distant: ventrally, beyond the end of the antennular peduncles, it is also armed with distant spines. All the spines are fixed.

The telson is shorter than the endopodite of the tail fan.

The ocellus at the dorsal margin of the eye is almost independent.

The antennular flagella are much longer than the entire body.

The external maxillipeds reach beyond the tip of the antennal scale by the whole length of their long terminal joint. All the legs are longer and slenderer: the 1st pair reach beyond the tips of the external maxillipeds by almost the whole length of their dactylus and propodite: the 2nd pair on the left side almost reach to the end of the external maxillipeds: the fifth pair are as long as the entire body less the telson. In the last 3 pairs of legs the spines on the posterior border of the merus are few and very fine.

In the Investigator collection is a single specimen from the Andaman Sea, 173 fathoms.

According to Spence Bate's figure, the 2nd pair of legs on the right hand side, if extended, would reach a long way beyond the end of the external maxillipeds. In our single specimen this leg is wanting.

Regd. No.  $\frac{20}{7}$ .

#### 55. *Pandalus (Plesionika) bifurca*, Alcock & Anderson.

*Plesionika bifurca*, Alcock & Anderson, Journ. Asiatic Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 155.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE LI. FIG. 6.

Rostrum from half to two-thirds the length of the rest of the carapace, its gastric carina high and compressed, serrated in almost all its extent both dorsally

and ventrally, the dorsal serrations numbering 8 or 9, the ventral from 3 to 5, all being fixed.

The 3rd abdominal tergum has the posterior border convex, but not acutely produced. The telson is as long as the 5th and 6th abdominal somites combined, the 6th somite being short. Of the four spines at the tip of the telson the outer one on either side is of most unusual length, even in the adult, the two forming a conspicuous caudal fork.

The ocellus is quite indistinct. The antennular peduncle reaches more than halfway along the antennal scale, the latter being little more than half the length of the carapace proper: the antennular flagella are longer than the combined carapace and rostrum.

The external maxillipeds are stouter and very much longer than the first pair of legs: the whole of their long terminal joint lies beyond the tip of the antennal scale and almost the whole of their terminal joint lies beyond the extended 1st pair of legs.

The 1st pair of legs are the shortest of all, and the left leg of the 2nd pair is the longest of all, reaching far beyond the end of the external maxillipeds and being as long as the carapace and rostrum and first 4 abdominal somites combined. The right leg of the 2nd pair is also long, reaching just beyond the external maxillipeds and being nearly as long as the legs of the 3rd pair, but it is shorter than its fellow by half the carpus of the latter. Of the last three pairs of legs the 3rd is the longest and the 5th the shortest: in all three the posterior border of the merus is spiny and the succeeding joints are sparsely setose.

Colours in life pink: eggs light blue.

In two egg laden females the dimensions, in the mid-dorsal line, are as follows:—

	Rostrum.	Carapace.	Abdomen.
No. 1	6.5 millim.	11 millim.	25 millim.
No. 2	11 „	15 „	33 „

This little species has been taken in the Arabian Sea near the Laccadives, in 636 fathoms; in the Bay of Bengal near the Andamans, in 240, 272, and 561 fathoms; and in the Andaman Sea in 173, 188–220, 250, 265, 238–290, 405, and 490 fathoms.

Regd. Nos.  $\frac{512-513}{7}$  and  $\frac{9271-9272}{9}$  (Types of the species):  $\frac{9934}{6} : \frac{21}{7} : \frac{23}{7} : \frac{47}{7} : \frac{3122}{9} : \frac{3191}{9} : \frac{6271-6272}{9} : \frac{6823-6826}{9} : \frac{513-514}{10}$ .

#### PARAPANDALUS, Borradaile.

*Parapandalus* (part) Borradaile in Willey's Zoological Results, Stomapoda and Macrura, p. 411.

Differs from *Plesionika* in having no epipodites behind the external maxillipeds.

56. *Pandalus (Parapandalus) spinipes*, Spence Bate.

*Plesionika spinipes*, Spence Bate, Challenger Crust. Macrura, p. 646, pl. cxiii, fig. 2.

Rostrum about  $1\frac{1}{2}$  times the length of the carapace proper, nearly straight in its basal third, moderately ascendant in its distal two-thirds; its dorsal and ventral borders are both very closely and evenly multiserrate, the dorsal border throughout, the ventral border anterior to a point a little in front of the eye; its low gastric crest hardly reaches the middle of the carapace. The serrations are comb-like and fixed.

The 3rd abdominal tergum has its posterior border somewhat convex, but not produced: the 6th is not twice as long as the 5th and is decidedly shorter than the telson: the telson is a little longer than the endopodite of the tail-fan.

The antennules, antennae and eyes are as in *P. martius*, but the ocellus is more distinct and usually quite separate from the eye.

The external maxillipeds reach beyond the antennal scale by the whole of their long terminal joint; though stouter they are a little shorter than the 1st pair of legs.

As in the species of *Plesionika*, the first pair of legs end in a microscopic chela, which is imperfect by reason of the shortness of the fixed finger and is a good deal hidden in setæ. The legs of the second pair are equal and reach just beyond the base of the terminal joint of the external maxillipeds: their chelæ are a good deal tufted with setæ. The last 3 pairs of legs are very long and slender, the 5th pair, which are the longest, are as long as the rostrum carapace and first  $5\frac{1}{2}$  abdominal somites combined: in all three the posterior border of the merus is, as usual, armed with slender distant spines, and the short dactylus springs from a tuft of lank setæ.

140 specimens were taken in one haul, off C. Comorin, in 143 fathoms.

In an egg-laden female taken at random the length of the rostrum is 29 millim., of the carapace proper 21 millim., and of the abdomen 57 millim., measured in the middle line.

Regd. No.  $\frac{3402}{10}$ .

## CHLOROTOCUS, A. Milne Edwards.

*Chlorotocus*, A. Milne Edwards, Recueil de Figures de Crustacés (1883), pl. 16: (?) Spence Bate, Challenger Crust. Macrura, p. 673.

This genus should perhaps rank only as a subgenus of *Pandalus*, from which it differs only in the form of the 2nd pair of thoracic legs, in which the carpus is subdivided into *two* unequal segments only.



It agrees with the subgenera *Plesionika* and *Parapandalus* in having the posterior lobe of the scaphognathite short broad and rounded off, and in the presence of an exopodite to the external maxillipeds.

It agrees with the subgenera *Pandalus* and *Plesionika* in having epipodites on the 1st four pairs of thoracic legs.

The branchial formula is exactly the same as that of *Pandalus* and not as given by Spence Bate.

### 57. *Chlorotocus gracilipes*, A. M. Edw.

*Chlorotocus gracilipes*, A. Milne Edwards, Rec. Fig. Crust. pl. 16: Carus, Prodrom. Faun. Medit., I. p. 474: Adensamer, Denk. Kais. Akad. Wien, LXV. 1898, p. 623.

#### *Chlorotocus gracilipes* var. *andamanensis*, Anderson.

Ann. Mag. Nat. Hist., April 1899, p. 284.

Rostrum about two-thirds the length of the rest of the carapace, nearly straight and horizontal, serrated both dorsally and ventrally—dorsally throughout, ventrally from in front of the eye: its gastric crest is continued on behind the middle of the carapace, which is otherwise smooth except for a broad, blunt, and very faint epibranchial ridge on either side. The usual orbital and branchiostegal spine are present.

The posterior border of the 3rd abdominal tergum is straight, not convex. The 6th abdominal tergum is only as long as the 5th, and the telson is as long as both combined and very slightly longer than the caudal swimmerets.

Eye large, globular, without an ocellus.

The antennular peduncle reaches rather more than halfway along the antennal scale: the antennular flagellum is about as long as the carapace proper.

The antennal scale is little more than half the length of the carapace: the spine at the far end of the outer border of the 2nd joint of the antennal peduncle is remarkably long.

The external maxillipeds and 1st pair of legs are setose; the former, which have a very well developed exopodite, are not stouter than the latter, but exceed them in length by the whole of their long terminal joint, which reaches well beyond the antennal scale.

The legs of the 2nd pair are a little unequal, one of them not quite reaching to, the other reaching a short way beyond the external maxillipeds: their carpus is divided into two unequal segments, and their chelæ are, *for a Pandaloid*, large, and have the palm longer than the fingers, and the dactylus furnished with a relatively large tooth at its proximal end.

The last three pairs of legs are moderately stout and not very long: the 3rd pair, which are the longest, reach beyond the external maxillipeds by their dactylus; the 5th pair, which are the shortest, do not reach the end of the carpus of the 1st pair. In the 3rd and 4th pairs the posterior border of the merus is spinose.

In the Investigator collection are two males and an egg-laden female, from the Andaman Sea, 185 fathoms.

In comparing our specimens with Milne Edwards' figure, the only obvious difference is that in the former the pleura of the 5th and 6th abdominal somites have their postero-inferior angles acutely produced, as in all the species of *Pandalus* with which I am acquainted, and not rounded off, as in the figure.

Regd. Nos.  $\frac{2126-2128}{10}$ .

#### HETEROCARPUS, A. Milne Edwards.

*Heterocarpus*, A. Milne Edwards, *Ann. Sci. Nat., Zool.*, (6) XI. 1851, Art. 4, p. 6: Spence Bate, *Challenger Crust. Macrura*, p. 627.

As *Pandalus*, with the following points of exception:—

The integument is hard and rigid: in addition to the median (post-rostral) crest, which is very long and strong, there are lateral longitudinal crests on the carapace: there is no ocellus at the margin of the eye.

As in some species of *Plesionika*, the legs of the 2nd pair are remarkably unequal.

In all the Indian species the external maxillipeds have a small exopodite, and epipodites are present on all the thoracic legs except the last; and in all, the scaphognathite is short, broad, and rounded.

The branchial formula is exactly the same as that of *Pandalus*. That is to say, there are epipodites on the appendages of the first 7 thoracic somites, a podobranch on the 2nd maxillipeds, two arthrobranchs on the external maxillipeds and one on each of the next four somites, and a pleurobranch on each of the last five thoracic somites—in all, 12 branchiæ and 7 epipodites on either side.

The crests of the carapace have been described by Faxon, in *Mem. Mus. Comp. Zool.* XVIII. 1895, p. 149. When fully developed there are, besides the median (post-rostral) crest, and besides the fine lateral marginal crest, three carinæ on either side.

The first, or "post-ocular" carina, which is the most constant and usually the best developed, runs from the middle of the orbital notch to the posterior border of the carapace: it may sometimes be deficient in its anterior two-thirds, or absent altogether.

The second, or "post-antennular" carina, is a continuation of the spine at the outer angle of the orbit: usually it is a mere buttress of this spine, but sometimes it is continued to the posterior border of the carapace, and occasionally (but not in any Indian species) it is entirely absent.

The third, or "post-antennal" carina, is also very constant: it is a continuation of the branchiostegal spine and runs towards the posterior border of the carapace, which sometimes it reaches and sometimes does not nearly reach.

*Synopsis of the Indian species of Heterocarpus.*

- I. The 6th abdominal somite is nothing like twice as long as the 5th and is much shorter than the telson:—
  1. None of the abdominal terga are in any way carinated or acutely produced posteriorly ... .. *H. tricarinatus.*
  2. The 3rd abdominal tergum is bluntly carinated:—
    - i. Rostrum in the adult much shorter than the carapace proper, armed dorsally with 3 or 4 teeth: the branchiostegal spine does not nearly reach the base of the antennal scale ... .. *H. gibbosus.*
    - ii. Rostrum, even in the adult, as long as the carapace, dorsally smooth except for a spine above the eye: the tip of the branchiostegal spine reaches well beyond the base of the antennal scale ... .. *H. lævigatus.*
  3. Some of the abdominal terga are sharply carinated and have some of the carinæ produced posteriorly into overhanging spines:—
    - i. The 3rd, 4th and 5th abdominal carinæ are produced as spines: none of the other abdominal terga are carinated ... .. *H. Alphonssi.*
    - ii. The 3rd and 4th abdominal carinæ are produced as spines: the 1st abdominal tergum is faintly, the 2nd sharply carinated ... .. *H. ensifer.*
- II. The 6th abdominal somite is twice as long as the 5th and as long as the telson: the 3rd abdominal tergum has a hump-like carina ... .. *H. Wood-Masoni.*

58. *Heterocarpus gibbosus*, Spence Bate.

*Heterocarpus gibbosus*, Spence Bate, Challenger Crustacea Macrura, p. 634, pl. cxii. fig. 2: Wood-Mason, Ann. Mag. Nat. Hist. (6) IX. 1892, pp. 368, 369, fig. 6.

Rostrum in the adult about three-fourths the length of the carapace, strongly recurved, continued nearly to the posterior border of the carapace as a very high compressed serrated carina: it is armed ventrally with numerous (from 10 to 16) teeth which are more or less concealed by cilia, and dorsally with 3 or 4 (usually 3) distant teeth which are much smaller than the six teeth of its carapacial carina. (In the young the rostrum is much longer than the carapace).

Of the carinae of the carapace the 1st, or postocular, and the 3rd or "post-antennal" are very distinct, the former reaching nearly to the posterior border, the latter being lost on the after part of the branchial region. The 2nd or "post-antennular" carina is a mere buttress to the orbital spine, with which it is continuous.

The branchiostegal spine, which is continuous with the post-antennal carina, does not project as far as the orbital spine.

The abdomen is smooth, except for a very broad blunt median carination of the 3rd tergum, the posterior border of which tergum is little convex. The 6th tergum is not very much longer than the 5th; and the telson, which is as long as both combined, is equal in length to the caudal swimmerets.

The antennular peduncle reaches nearly to the anterior third of the antennal scale, its first joint is much the longest: the very acute antennular scale reaches nearly to the end of the 2nd joint, and has a little secondary lobule at the base of its outer margin. The antennular flagella are longer than the combined carapace and rostrum.

The antennal scale is about half the length of the carapace proper, its greatest breadth is about two-fifths its length: the midrib is very strong and the outer border is broadly thickened, trenchant, and ends acutely. At the far end of the outer border of the 2nd joint of the antennal peduncle is a spine.

The external maxillipeds are longer and very much stouter than the 1st pair of legs; they reach beyond the antennal scale by half their terminal joint, which is dorsally spinose: their exopodite is small.

As Calman has noticed, the 1st pair of legs—which just, or barely, reach the tip of the antennal scale,—end in a very imperfect subchela of such minute size as to be recognizable only under the microscope.

The legs of the 2nd pair are very unequal in length and a little unequal in thickness. The leg on one side is as stout as any of the posterior legs and ends in a chela of some size, but does not reach further than the end of the antennular peduncle: its fellow on the other side is slenderer than the posterior legs, ends in the usual small chela, and reaches beyond the tip of the antennal scale by a third of its long carpus.

The last three pairs of legs are very nearly of a length, the 5th pair being a little the shortest: the 3rd pair reach beyond the antennal scale by a little more than their two terminal joints: in all of them the posterior border of the merus is spinose and the same border of the next three joints carries some microscopic spinelets, and the dactylus is very short.

Colour in life pink, legs pink and white.

In the largest egg-laden female of the collection the length of the rostrum is 32 millim., of the carapace 42 millim., and of the abdomen 82 millim. In the



largest male the rostrum is 27 millim., the carapace 34.5 millim., and the abdomen 70 millim.

The species is fairly common: it has been taken in the Andaman Sea, in 185, 188-220, 194 and 198 fathoms, in the Bay of Bengal, off the Madras coast, in 145-250 and 240 fathoms, and in the Arabian Sea, off the Travancore coast, in 224-284 fathoms.

Regd. Nos.  $\frac{8575}{6}$  :  $\frac{502}{7}$  :  $\frac{4255-4260}{7}$  :  $\frac{6787-6795}{9}$  :  $\frac{6797}{9}$  :  $\frac{1408-1409}{10}$  :  $\frac{2116-2119}{10}$  :  $\frac{2510}{10}$  :  $\frac{2512-2513}{10}$  :  $\frac{3388-3391}{10}$ .

### 59. *Heterocarpus laevigatus*, Spence Bate.

*Heterocarpus laevigatus*, Spence Bate, Challenger Crustacea Macrura, p. 636, pl. cxii. fig. 3: Anderson, Ann. Mag. Nat. Hist. (7) 111. 1899, p. 285.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLII. FIGS. 1, 1a.

Closely resembles *H. gibbosus* from which it differs only in the following characters:—

The rostrum, in the adult, is as long as the carapace proper: it is multi-serrate ventrally as in *H. gibbosus*, but dorsally there is a single tooth just in front of the eye, beyond which it is quite smooth: its posterior prolongation, or crest, is not so high, and is not more than 5-serrate.

The carinae of the carapace are as in *H. gibbosus*, but the 1st, or "post-ocular," is straighter, and the 3rd, or "post-antennal," is continued further back. Moreover, below the latter, near the postero-lateral angle of the carapace, is an additional short oblique carina.

The branchiostegal spine is broad and trenchant: its point projects far beyond the orbital spine, and beyond the base of the antennal scale.

The 3rd abdominal somite is bluntly carinated as in *H. gibbosus*, but its posterior border is strongly convex, though not acutely produced.

The sharp antennular scale projects beyond the 2nd joint of the antennular peduncle.

The antennal scale is more than half the length of the carapace, and its greatest breadth is about a third of its length.

The 3rd pair of legs are slightly longer than the 4th and 5th pairs; but with this exception, and excepting also that they are all *slightly* shorter, the legs and external maxillipeds have *inter se* the same relative proportions as in *H. gibbosus*, and the same details of structure.

In the largest egg-laden female the rostrum is 42 millim. long, the carapace 44 millim., and the abdomen 79 millim. In the largest male the rostrum is 55 millim., the carapace 44 millim., and the abdomen 82 millim.

Arabian Sea, off the Travancore coast, 430 and 457-589 fathoms.

Regd. Nos.  $\frac{2108-2115}{10} : \frac{3853}{10}$ .

60. *Heterocarpus alphonsi*, Spence Bate.

*Heterocarpus alphonsi*, Spence Bate, Challenger Crust. Macrura, p. 632, pl. cxii, fig. 1 : Wood-Mason, Ann. Mag. Nat. Hist. (6) VII. 1891, p. 196.

Rostrum, in the adult, about  $1\frac{3}{4}$  times the length of the carapace proper, continued nearly to the posterior border of the carapace as a low coarse, but very distinct, carina, on the gastric portion of which are 2 teeth: it is armed along all its ventral extent with from 10 to 13 teeth, and dorsally with 7 or 8, not including the two on the carina. In the young the rostrum is more than twice the length of the carapace proper.

The carinæ of the carapace correspond with those of *H. gibbosus*, but the "post-antennal," like the "post-ocular" is continued to its posterior border.

The branchiostegal tooth projects beyond the 2nd joint of the antennal peduncle.

The 3rd, 4th, and 5th abdominal terga are sharply carinated, the carina in each case being produced posteriorly into a long and sharp spine.

The antennular peduncle does not reach quite halfway along the antennal scale, but otherwise is as in *H. gibbosus*: the flagella are not quite as long as the combined carapace and rostrum.

The antennal scale is nearly two-thirds the length of the carapace proper, and is at least 3 times as long as broad.

Though the legs and external maxillipeds have the same details of structure, and *inter se* the same proportions, as in *H. gibbosus*, they are much slenderer and *much* shorter, none of them—excepting only the longer one of the 2nd pair of legs—reaching beyond the antennal scale: moreover the external maxillipeds are very little longer than the 1st pair of legs.

Colour in life deep pink.

In the largest egg-laden female the rostrum is 54 millim. long, the carapace 31 millim., and the abdomen 77 millim. In the largest male the rostrum is 44 millim., the carapace 27 millim., and the abdomen 66 millim.

Arabian Sea, near the Laccadives and in the Gulf of Manár, in 480, 595-556, 675, 696, 636 and 740 fathoms; Bay of Bengal, 753 and 561 fathoms; and Andaman Sea, 490 and 500 fathoms.

The specimens taken in 561 fathoms were brought on board alive, and poured out, apparently from the orifice of the green-gland, abundant clouds of a highly luminous substance of a pale-blue colour.

Regd. Nos.  $\frac{8520}{6} : \frac{42}{7} : \frac{3167}{9} : \frac{6029-6037}{9} : \frac{6277}{9} : \frac{6778-6785}{9} : \frac{9238-9243}{9} : \frac{3392}{10} : \frac{3848-3849}{10}$ .

61. *Heterocarpus ensifer*, A. M. Edw.

*Heterocarpus ensifer*, A. Milne Edwards, Ann. Sci. Nat., Zool., (6) XI. 1881, Art. 4, p. 8, and Rec. de Fig. Crust., pl. 32: Spence Bate, Challenger Crust. Macrura, p. 638, pl. cxii. fig. 4: Borradaile, Stomapoda and Decapoda of Willey's Exped., p. 413.

? *Pandalus carinatus*, S. I. Smith, Bull. Mus. Comp. Zool., X. 1882, p. 63, pl. x. figs. 2-2f and pl. xi. figs. 1-3.

*Heterocarpus carinatus*, Wood-Mason, Ann. Mag. Nat. Hist., (6) IX. 1892, p. 369.

Rostrum long, serrated dorsally and ventrally, continued nearly to the posterior border of the carapace as a serrated carina.

In addition to the postrostral crest, and in addition to the fine marginal ridge, there are *on either side of the carapace three well developed carinae*.

The 1st, or "post-ocular," is very indistinct as far as the cervical groove, whence it is continued as a sharp carina to the posterior border of the carapace.

The 2nd, or "post-antennular," runs without interruption from the posterior border of the carapace into the orbital spine.

The 3rd, or "post-antennal," runs from the posterior border of the carapace, uninterruptedly into the branchiostegal spine.

The 1st abdominal tergum has a faint median carina, and *the 2nd a sharp one which ends abruptly*: the 3rd and 4th terga are also sharply carinated, but the carina, in each, is produced posteriorly into a sharp spine.

The legs and external maxillipeds though corresponding in structural details with, and having *inter se* the same relations as, those of *H. gibbosus*, are slenderer and very much shorter, none of them reaching beyond the antennal scale.

In the Investigator collection is a single young specimen, from the Andaman Sea, 188-220 fathoms. As it is young and not in the best state of preservation, I have merely recorded here the most obvious diagnostic points.

Regd. No.  $\frac{6798}{9}$ .

62. *Heterocarpus tricarinatus*, Alcock & Anderson.

*Heterocarpus tricarinatus*, Alcock and Anderson, Journal Asiatic Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 154.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE LI. FIG. 1.

Rostrum, in the adult, about five-sixths the length of the carapace, strongly recurved, continued as a high compressed serrated gastric carina that fades away some little distance in front of the posterior border of the carapace: ventrally it is armed with 7 to 10 teeth, dorsally with at least 7 not including 5 on the gastric carina.

The 1st, or "postocular," carina runs nearly to the posterior border of the carapace; the 2nd, or "postantennular" forms merely a buttress to the strong orbital spine; the 3rd, or "postantennal" fades away on the anterior part of the branchial region.

The abdominal terga—even the 3rd—are quite smooth and non-carinate.

The antennules and antennæ are as in *H. gibbosus*, except that the antennular flagella are as long as the body *minus* only the telson.

Except that the 1st pair of legs are longer and reach further beyond the antennal scale, the legs and external maxillipeds have the same structure and proportions—both *inter se* and with regard to the rest of the body—as those of *H. gibbosus*: moreover the spines on the posterior border of the carpus of the last three pairs of legs are as large as those on the posterior border of the merus.

In an egg-laden female the length of the rostrum is 21 millim., of the carapace 24 millim., of the abdomen 49 millim.

Found only in the Arabian Sea, in the neighbourhood of the Laccadives and northwards, in 865–880 and 890 fathoms.

Colour in life, pink.

Regd. Nos.  $\frac{9244-9246}{9}$  (Types of the species):  $\frac{373}{10}$ .

### 63. *Heterocarpus Wood-masoni*, n. sp.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PL. LI. FIG. 2.

The following are the diagnostic points:—

Rostrum long, serrated dorsally and ventrally, and continued nearly to the posterior border of the carapace as a carina which is very indistinct behind the gastric region where it carries its only two teeth.

The true 1st or “postocular” carina, that in other species runs from the middle of the orbital notch, is here entirely wanting. The true 2nd or “post-antennular” carina, that in the other species is merely a buttress to the orbital spine, is here a long carina running uninterruptedly from the posterior border of the carapace into the orbital spine. The 3rd or “post-antennal” carina, running from the posterior border of the carapace into the branchiostegal spine, is very distinct, and lastly the marginal carina is unusually well defined.

The abdominal terga are smooth, except for a compressed hump-like elevation in the middle of the 3rd.

The 6th abdominal somite is as long as the telson and twice as long as the 5th.

*Inter se* the legs and external maxillipeds have much the same proportions as in *H. gibbosus*, but they are slenderer and much shorter, none of them reaching beyond the antennal scale.

Two young specimens from the Andaman Sea: 265 fathoms.

Regd. No.  $\frac{3124}{9}$  (Types of the species).



## DORODOTES, Spence Bate.

*Dorodotes*, Spence Bate, Challenger Crust. Macrura, p. 677.

As *Pandalus*, except that the integument is thicker, and the eyes are very small—their diameter being less than that of the eyestalk—and have no ocellus.

As in *Heterocarpus*, *Chlorotocus* and *Plesionika*, &c., the external maxillipeds have an exopodite (which is larger in *Dorodotes* than in any other Pandaloid), and the scaphognathite is short, broad and rounded; and, as in all except *Parapandalus*, there are epipodites on all the thoracic legs except the last.

The branchial formula is exactly the same as that of *Pandalus*, *Chlorotocus* and *Heterocarpus*; that is to say, there are epipodites to the first 7 thoracic appendages, a podobranch on the 2nd maxillipeds, two arthrobranchs to the external maxillipeds and one to each of the next four somites, and a pleurobranch on each of the last 5 somites—in all, 12 branchiæ and 7 epipodites on either side.

64. *Dorodotes reflexus*, Spence Bate.

*Dorodotes reflexus*, Spence Bate, Challenger Crust. Macrura, p. 678, pl. cxvi. fig. 3: Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 195.

Rostrum about half as long as the carapace proper, much compressed, very broad at base and acute at tip, ascendant and nearly straight, 5-7-serrate ventrally, 5-6-serrate dorsally, where it is continued backwards beyond the gastric region as a high compressed 8-9-serrate carina.

Except for this serrated carina and for a small orbital and branchiostegal spine, the carapace is smooth, and in life very greasy.

Abdomen moderately compressed, smooth, non-carinate; the 3rd tergum has a very strongly convex, but not acute, posterior border. The 6th tergum is not much longer than the 5th: the telson is a little longer than the 5th and 6th combined, and its spines are strong and erectile.

Eyes very small, but well pigmented, not so broad as the eyestalks.

The antennular peduncle reaches more than halfway along the antennal scale: its scale is compressed and acute, and reaches slightly beyond the 1st joint, which is the longest: the antennular flagella are much longer than the combined carapace and rostrum.

Antennal scale about half as long as the carapace and nearly 3 times as long as broad: the midrib is stout and the outer border is broadly thickened and ends acutely. The usual spine is present at the far end of the outer surface of the 2nd joint of the antennal peduncle.

The external maxillipeds, which reach to the tip of the antennal scale and have their terminal joint dorsally spinose, are longer and much stouter than the 1st pair of legs.

The first pair of legs, though apparently simple, yet when examined under the microscope are found to end in a *microscopic chela the fingers of which are of equal length*: it looks more like a split claw than an ordinary chela.

The legs of the 2nd pair are equal and symmetrical: they are a little shorter than those of the 1st pair and reach nearly halfway along the terminal joint of the external maxillipeds: their chelæ are of fair size, having the fingers nearly as long as the palm.

Of the last three pairs of legs the 3rd pair are the longest—reaching beyond the antennal scale by their dactylus and two-thirds of their propodite, and the 5th pair are the shortest—not reaching the tip of the antennal scale: in all of them the posterior border of the ischium and merus is spinose and some slender spinelets are to be found on the same border of the carpus and propodite.

The protopodites of the abdominal appendages are very stout.

In an egg-laden female the rostrum is 20 millim. long, the carapace 34 millim., and the abdomen 69 millim.

Colours in life bright pink, legs crimson. The eggs are of two kinds, small ones of a light brown colour, and large ones of a bright pink colour.

From the Bay of Bengal, 1300, 1310, 1439, and 1644 fathoms.

Regd. Nos.  $\frac{7671}{6}$  :  $\frac{6100-6106}{9}$  :  $\frac{6761-6766}{9}$ .

#### Family *Psalidopodidae*, Wood-Mason.

Wood-Mason, Ann. Mag. Nat. Hist., April 1892, p. 265: Ortmann in Bronn's Thier Reich, Malacostraca, p. 1128.

Rostrum long, recurved. The abdomen articulates with the carapace by a hinge, and the abdominal somites interarticulate by means of little shallow ball-and-socket joints situated at the junction of terga and pleura. Telson long and narrow.

The antennular scale is rigid and very acute: the antennal scale is foliaceous, but narrow. Two antennular flagella.

Mandible deeply cleft into two processes—incisor and molar—and furnished with an incurved two-jointed palp; the molar process is broad and strong, but the incisor process is a thin flexible imperfectly-calcified plate. The exopodite of the 1st maxillipeds is a simple incurved falciform plate, without a flagellum.

The coxa and basis of the 1st maxilla are equally well developed, but the coxæ of the 2nd maxilla and 1st maxillipeds are small and receding. External maxillipeds pediform, their two terminal segments with short stiff setæ, which on the last (5th) segment are so arranged as to give the segment a multiarticulate appearance. Terminal segment of the 2nd maxillipeds much as in the *Crançonidæ*.

The 1st pair of thoracic legs end in forficulate chelæ, both fingers being movable blades which cross each other like scissors. The 2nd pair have the carpus unsegmented and have the dactylus replaced by a pencil of setæ. The last 3 pairs are stout and monodactylous. There are no exopodites on any of the thoracic legs.

Eggs few and large.

#### PSALIDOPUS, Wood-Mason.

*Psalidopus*, Wood-Mason, Ann. Mag. Nat. Hist., April 1892, p. 265.

Body compressed, longitudinally-carinate dorsally, its integument covered everywhere, except ventrally, with long definitely arranged needle-like spines between which it is hispid with minute stiff setæ.

Rostrum of very great length, upcurved, quadrangular in transverse section and armed along all four edges with rigid procurved spines.

Carapace short, the anterior edge of the 1st abdominal somite, at the point of junction of tergum and pleuron, is folded and clinched over its raised posterior border so as to form a hinge. The abdominal somites interarticulate by means of little shallow ball-and-socket joints, placed—the socket being in the anterior margin—at the junction of terga and pleura. The abdominal pleura are of no great width fore and aft, but are rather vertically produced, and have the free edge spinose. Telson about as long as the caudal swimmerets, narrow and tapering but truncated, hispid and longitudinally-grooved dorsally.

Eyestalks short and having very limited motion: eyes very small, non-pigmented and non-faceted.

Antennular peduncle short, its basal joint carries, externally, a rigid scale which ends very acutely: the antennular flagella, which are two in number, are of considerable length, the outer is the thicker, especially in the male.

Antennal scale very long and narrow, with a triangular tip, its outer edge is thickened and serrated and ends very acutely, and in addition to this it is strengthened by a midrib: antennal flagellum very long.

The spatulate end of the mandibular palp is beset with stiff spine-like setæ. Exopodite of the external maxillipeds well developed, the epipodite represented by a small compressed tubercle.

The first 2 pairs of thoracic legs are much shorter than the last 3 pairs, and the 5th pair is the longest of all. In the 1st pair the joints up to the carpus are not stouter than the corresponding joints of the 2nd pair, but the hand is moderately enlarged and inflated and ends in two equally-movable fingers, which cross each other like scissors and have the distal moiety of their apposed edges finely serrated. The 2nd pair of legs are slender, have an undivided carpus, and end in

a pencil of setæ. The last 3 pairs have the ventral border of the ischium and merus closely spinose, and also have some spines and spinelets on some of the other joints: their dactyli are sharp and curved and have some very fine spinelets along the ventral border.

The abdominal appendages are all biramous, and have singularly long protopodites, the postero-external edge of which is beset with bristle-like spinules: all the rami, except the inner ramus of the 1st pair, are long and narrow: all the endopodites behind those of the 1st pair have a short internal appendix, and in those of the 2nd pair in the male there are two of these.

The exopodite of the tail-fan is imperfectly divided into two segments by an incomplete transverse suture.

The branchiæ are 5 in number on either side, being pleurobranchiæ attached to somites X to XIV. In addition, 5 microscopic papillæ are found—the vestiges of lost arthrobranchiæ—on somites IX–XIII. Epipodites are present on the 1st and 2nd maxillipeds; but on the coxæ of the external maxillipeds and 1st thoracic legs there are small tubercles which may be the remains of lost epipodites.

The efferent branchial channel is remarkably well defined by a incurved process of the inflected postero-inferior angle of the carapace, the process firmly catching the undermined posterior border of the last thoracic sternum.

*Key to the (Indian) species of Psalidopus.*

- |  |     |     |     |                         |
|--|-----|-----|-----|-------------------------|
| I. The thoracic and abdominal sterna unarmed ...   | ... | ... | ... | <i>P. Huxleyi.</i>      |
| II. The last three thoracic and all the abdominal sterna with a needle-like median spine ... | ... | ... | ... | ...                     |
|  |     |     |     | <i>P. spiniventris.</i> |

65. *Psalidopus Huxleyi*, Wood-Mason.

*Psalidopus Huxleyi*, Wood-Mason, Ann. Mag. Nat. Hist., April 1892, p. 273, pl. xiv. figs. 1, 2, 7.  
ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE LI. FIGS. 5, 5a-b.

Rostrum nearly twice as long as the rest of the carapace, with 4 rows of spines, dorsal, ventral and 2 lateral; the dorsal row is continued to the posterior border of the carapace as a spiny carina, and the lateral rows are also continued to the posterior border of the carapace as sinuous spiny ridges. Besides these spiny carinæ, and besides many other spines, the ridges that define the branchial regions above and below, and the ridge that defines the branchial canal superiorly, are spiny.

Abdomen with a median spiny carina extending to the posterior border of the 6th tergum, trifurcate on the 5th tergum: with an irregular row of spines on either side at the level of the junction of pleura and terga, and with other spines between these rows. Tips of the pleura spinose. Dorsal surface of telson thickly hispid.



Thoracic and abdominal sterna smooth, except that the 6th abdominal sternum is hispid and is armed with a recurved spine between the bases of the caudal swimmerets.

Antennular peduncle not half the length of the antennal scale, its basal joint is the longest and its scale has the outer edge spiny and ends in a long acicle: the terminal joint also carries a spine: the flagella are longer than the carapace (not including the rostrum).

The distal border of the 2nd joint of the antennal peduncle is spinose: the hispid antennal scale is nearly 4 times as long as broad and more than two-thirds the length of the carapace (without rostrum): antennal flagellum much longer than the entire body.

Except for their stout third segment the external maxillipeds are not stouter than the 2nd pair of legs.

The 1st pair of legs, which are about the same length as the external maxillipeds, do not reach halfway along the antennal scale: the upper border of the merus and carpus is spinulate up to a terminal spine: the palm is compressed cylindrical, about  $2\frac{1}{2}$  times as long as broad, and hardly decreases in breadth forwards: the fingers, which are nearly straight, are about two-thirds as long as the palm.

The 2nd pair of legs reach slightly beyond the base of the fingers of the 1st pair; the 3rd pair reach within a short distance of the tip of the antennal scale, and are about the same length as the 4th pair; the 5th pair reach nearly a dactylus length beyond the tip of the antennal scale.

A single female from the Andaman Sea,  $7\frac{1}{2}$  miles east of N. Cinque I., 490 fathoms.

The length of the free portion of the rostrum is 51.5 millim., of the carapace 28.5 millim., of the abdomen 63 millim., measured in the middle line.

Regd. No.  $\frac{41}{7}$  (Type of the species).

### 66. *Psalidopus spiniventris*, Wood-Mason.

*Psalidopus spiniventris*, Wood-Mason, Ann. Mag. Nat. Hist., April 1892, p. 273, pl. xiv. figs. 3-6, pl. xv. figs. 1-10.

Differs from *P. Huxleyi*, females compared, in the following points only:—

The last 2 thoracic and all the abdominal sterna are armed with a median vertical needle-like spine.

The 2nd pair of thoracic legs reach to the tips of the fingers of the 1st pair.

The rostrum may be more than twice the length of the rest of the carapace.

Colour in life, pink with white points.

In the largest female the length of the rostrum is 51.5 millim., of the carapace 25 millim., of the abdomen 59 millim.

Andaman Sea <sup>Sta. 116</sup> 405 and 500 fathoms; Arabian Sea, in the neighbourhood of the Laccadives, <sup>Sta. 177?</sup> 636 fathoms, and off C. Comorin 480 fathoms.

Regd. Nos.  $\frac{8514}{6}$  :  $\frac{6745-6747}{9}$  :  $\frac{3409-3410}{10}$  (Types of the species) :  $\frac{9212}{9}$ .

### Family *Crangonidæ*, Bell.

Bell, British Stalk-eyed Crust., p. 255: Spence Bate, Challenger Crust. Macrura, p. 481: Stebbing, Hist. Crust., p. 224, and South African Crust. in C. of Good Hope Marine Invest., p. 46: Ortmann, Proc. Ac. Nat. Sci. Philad., 1895, p. 174, and in Bronn's Thier Reich, Malacostraca, p. 1133.

Carapace short. Rostrum short, not laterally compressed. Basal joint of antennular peduncle slightly concave dorsally, and with a scale or spine on its outer border, at base: two short antennular flagella. Antennal scale usually foliaceous.

Mandibles slender, incurved, not deeply cleft into divaricating incisor and molar branches, without palp. The 2nd maxillæ have the coxa and basis, and the 1st maxillipeds the coxa, much reduced. All the maxillipeds have exopodites terminating in slender flagella. The terminal segment of the 2nd maxillipeds is a narrow plate attached along all its extent to the inner border of the propodite, as if it were a complemental piece of the latter. External maxillipeds stout, pediform.

First pair of thoracic legs much the stoutest of all, subchelate, the dactylus closing on the oblique distal border of the hand, the fixed finger being an oblique spine: 2nd pair of legs with simple carpus, usually slender and chelate, sometimes not chelate, sometimes wanting: 3rd pair much slenderer than the 4th and 5th.

The first pair of thoracic legs alone *sometimes* have an exopodite.

#### *Key to the genera and subgenera of the Crangonidæ of the Indian Benthos and Oligobenthos.*

- I. Eyes well developed: 2nd pair of legs chelate:—
  1. No exopodite to the 1st pair of thoracic legs: seven branchiæ on either side ... .. PONTOPHILUS.
  2. First pair of thoracic legs with a setose exopodite: eight branchiæ on either side: carapace and abdomen multicarinate:—
    - i. The first 5 abdominal sterna with a strong median spine: the first 5 abdominal pleura deep and pointed ... .. AEGEON.
    - ii. The first 5 abdominal sterna without a median spine: the abdominal pleura wide and rounded ... .. PARAPONTOCARIS.
- II. Eyes absent: 2nd pair of legs non-chelate: five branchiæ on either side ... .. PRIONOCRANGON.

## PONTOPHILUS, Leach.

*Pontophilus*, Leach, Malac. Podoph. Brit., pl. xxxvii A. 1815: Spence Bate, Challenger Crustacea Macrura, p. 486: Ortmann, Proc. Ac. Nat. Sci. Philad. 1895, p. 182 (*part*).

Carapace little compressed: abdomen long. Eyestalks short: eyes of good size. The antennules and antennæ arise almost in the same horizontal plane. The scale on the outer side of the basal joint of the antennule is styliform: antennular flagella short. Antennal scale long and of only moderate breadth.

In all three pairs of maxillipeds the flagellum of the exopodite is bent strongly inwards.

1st pair of thoracic legs without an exopodite: 2nd pair chelate, very short—less than half the length of the 1st pair.

All the abdominal appendages are foliaceous and biramous, the rami being little unequal. In all but the 1st pair there is a small styliform lobe at the base of the endopodite. Eggs of deep-sea species few and large.

The branchiæ are 7 in number on either side as follows:—

Somites.	Podobranchiæ.	Pleurobranchiæ.	
VII	ep.	0	= 0 ep.
VIII	1+ep.	0	= 1+ep.
IX	0 ep. r.	1	= 1+ep. r.
X	0	1	= 1
XI	0	1	= 1
XII	0	1	= 1
XIII	0	1	= 1
XIV	0	1	= 1
Total	1+2 ep.+ep. r.	6	= 7+2 ep.+ep. r.

*Synopsis of the Indian deep-sea species of Pontophilus.*

- I. Two spines on the median carina of the carapace, one gastric the other cardiac ... .. *P. gracilis*.
- II. Three spines on the median carina of the carapace, two gastric, the third cardiac ... .. *P. abyssi*.

67. *Pontophilus gracilis*, S. I. Smith.

*Pontophilus gracilis*, S. I. Smith, Bull. Mus. Comp. Zool. X. 1882, p. 36, pl. vii. figs. 2-3a, and Rep. U. S. Fish. Comm. for 1885, pl. xi. figs. 1-2: Wood-Mason, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 361: Ortmann, Proc. Acad. Nat. Sci. Philad. 1895, pp. 183, 186.

Rostrum very slender throughout, reaching at least to the ends of the eyes, with a spinule on either side not far from its base.

Besides the orbital and post-antennal spines—the latter of which ends in advance of the tip of the rostrum—there are six spines on the carapace, namely, an hepatic and an epibranchial on either side, and a gastric and a cardiac in the

middle line, the two latter and the epibranchial being the acute endings of carinæ, which carinæ are very distinct in the young.

The carapace is so thin that the gills can be seen through it, and measured in the middle line it is about a third the length of the abdomen. The 6th abdominal somite is twice as long as the 5th and nearly as long as the telson.

Eyes very large, placed obliquely on the short stalks, dull and opaque.

The antennular peduncle hardly extends to the middle of the antennal scale; its basal scale, which is spine-like, reaches to the end of the basal joint: the antennular flagella, in the female, are of about equal thickness, and the outer one reaches to, the inner one a short way beyond, the tip of the antennal scale.

The antennal scale, which is slender, is about three-quarters the length of the carapace (without the rostrum) measured in the middle line; its outer edge ends very acutely: the flagellum is about twice the length of the carapace.

External maxillipeds very stout: they reach, by at least half their terminal joint, beyond the tip of the antennal scale.

The first pair of thoracic legs, even with the dactylus flexed, reach a short way beyond the tip of the antennal scale. The slender 2nd pair reach hardly halfway along the merus of the 1st pair. The last two joints of the extremely slender 3rd pair lie beyond the end of the antennal scale, when fully pronated. The stoutish 4th and 5th pairs, which end in vertically-compressed dactyli, reach a short way beyond the tip of the antennal scale.

Colour in life: transparent clouded purple, eyes milky orange. Length of carapace 12 millim., of abdomen 35 millim., measured in the middle line.

Found here in the Andaman Sea, and off the Andaman coast of the Bay of Bengal, in 265, 561, and 583 fathoms.

A small specimen from the Andaman Sea, 238-290 fathoms, differs only in having the outer antennular flagellum many times thicker than the inner, and almost as stout as the peduncle. It is probably the male of this species.

Regd. Nos.  $\frac{9935}{6} : \frac{3125}{9} : \frac{6740}{9} : \frac{6743}{9}$ .

### 68. *Pontophilus abyssi*, S. I. Smith.

*Pontophilus abyssi*, S. I. Smith, in Report U. S. Fish. Comm. for 1882, p. 363; and for 1885, Albatross Decapoda, p. 49, pl. xi. figs. 3, 3a; Wood-Mason, Ann. Mag. Nat. Hist. (6) VIII. 1891, p. 361; Ortmann, Proc. Acad. Nat. Sci. Philad. 1895, pp. 153, 185.

Differs from *P. gracilis* only in the following particulars:—

(1) the rostrum does not reach to the end of the eyes, and the carapace is considerably more than a third the length of the abdomen:



(2) besides the orbital and post-antennal spines, there are on either side an hepatic, an epibranchial, and a small post-orbital spine—the two latter being acute endings of well marked carinæ; and, on the strongly pronounced mid-dorsal carina, 2 gastric spines and a cardiac spine:

(3) the eyes are not set very obliquely on the stalks and are much smaller:

(4) the antennular peduncle reaches little more than a third the way along the antennal scale.

Colours in life clouded purple, eyes milky orange. Length of carapace 18 millim., of abdomen 47 millim., measured in the middle line.

Bay of Bengal 1748 and 1997 fathoms.

Regd. Nos.  $\frac{6741-6742}{9}$ .

#### ÆGEON, (Risso) Guérin-Méneville, Stebbing.

*Ægeon*, Risso, Hist. Nat. Crust. Nice, p. 99. (Type *E. loricatus*, Riss. = *E. cataphractus*, Oliv.).

ÆGEON, Guérin-Méneville, Exp. Sci. Morée (*apud* Stebbing): Kinahan, Proc. Roy. Irish Acad. VIII. 1864, p. 74: Carus, Prodr. Faun. Medit. I., p. 483: STEBBING, MARINE INVESTIGATIONS IN S. AFRICA, CRUSTACEA, p. 50 (*ubi synonym.*).

*Pontocaris*, Spence Bate, Challenger Crustacea Macrura, p. 495: Ortmann, Proc. Acad. Nat. Sci. Philad. 1895, p. 175.

Having dissected a specimen of *Ægeon cataphractus* (the type of the genus) I must give my unqualified support to Mr. Stebbing's synonymy.

Integument very hard and thick.

Rostrum short, depressed. Carapace broad, its anterolateral angles produced, longitudinally multicarinate, the carinæ being usually seven in number, namely, a median, and on either side a dorsal, a lateral, and a supra-marginal.

Abdomen not compressed, its terga and pleura sculptured, the pleura being of moderate breadth fore and aft, and being more or less produced in a vertical direction. The first 5 abdominal sterna with a strong median spine.

Eyestalks short; eyes of moderate size. Antennules distinctly dorsal of the antennæ, the basal joint of the peduncle is dorsally concave, and its scale, though acute, is broad and squamiform: antennular flagella short, the outer one in the male is in part foliaceous and vastly broader than the inner one, but in the female both are cylindrical and of nearly equal thickness. Antennal scale broadly foliaceous.

The flagella of the exopodites of all the maxillipeds are bent strongly inwards. The first pair of thoracic legs are like those of *Pontophilus*, but have a short setose exopodite. The 2nd pair, which are slender and chelate, are of variable length *even sometimes in the different sexes of the same species*. The last 3 pairs of thoracic legs are as in *Pontophilus*, the dactyli of the last 2 pairs being sometimes so much vertically-compressed as to be almost palmulate.

All the abdominal appendages are foliaceously biramous, and in all but the first pair the endopodite has a short styliform lobe at base. No transverse suture in the exopodite of the caudal fan. Eggs small and numerous.

The branchiæ are *eight* on either side, there being, in addition to the five large pleurobranchiæ of the last five thoracic somites, and in addition to the small but well-formed podobranch of the 2nd maxilliped, *two* branchiæ attached to the somite of the external maxillipeds, of these two, one is large and although it appears to belong to the series of pleurobranchiæ really is an arthrobranch, while the other is small (and easily overlooked) and is a pleurobranch. The formula is as follows:—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.	Pleurobranchiæ.		
VII	(ep.)	0	0	=	ep.
VIII	1 (ep.)	0	0	=	1+ep.
IX	0	1	1	=	2
X	0	0	1	=	1
XI	0	0	1	=	1
XII	0	0	1	=	1
XIII	0	0	1	=	1
XIV	0	0	1	=	1
Total	1+2 ep.	1	6	=	8+2 ep.

#### *Synopsis of the Indian species of Aegeon.*

- I. Marginal carina of carapace smooth: pleura of first 5 abdominal somites vertically produced and acute ... .. *Æ. affine.*
- II. Marginal carina of carapace beaded: first 5 abdominal pleura vertically produced but with truncated tips ... .. *Æ. medium.*

#### 69. *Aegeon affine*, n. sp.

an *Pontocaris pennata* Bate, Chall. Macr. Crust., p. 499, pl. xci.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE LI. FIGS. 3, 4.

Rostrum triangular, bifid at tip usually, not reaching halfway along the eyestalks, with a minute spine on either side at base.

All 7 carinæ of the carapace are salient, and all but the supra-marginal one on either side are coarsely serrate. The lateral carina of each side ends in a huge wing-like tooth, beneath which is the spine formed by the termination of the branchiostegal margin. The non-serrate supra-marginal carina ends in a little tooth, anteriorly.

The abdominal terga, besides much transverse and oblique sculpturing, are carinated longitudinally. The 1st, 5th and 6th terga, and the telson, have two

median carinæ, the 2nd, 3rd and 4th have one. The carinæ of the 1st and 2nd terga end in a short coarse antrorse tooth, the carinæ of the 5th are notched in the middle, the carinæ of the 6th are retrorsely serrated. The telson ends acutely. The pleura of the first 5 abdominal somites are vertically produced to an acute point. The median spines of the first 5 abdominal sterna decrease in size from before backwards.

Eyestalks longish; the eyes, which are small, reach nearly to the end of the basal joint of the antennular peduncle.

The two terminal joints of the antennular peduncle are very short. The antennular flagella differ greatly in the two sexes: in the female they are cylindrical, and the inner, though a little longer, is not appreciably slenderer than the outer: in the male the outer flagellum is, in its basal three-fourths, vastly broader than the inner, being almost foliaceous.

The antennal scale is very broadly foliaceous: its length is not a third that of the carapace, its outer margin ends anteriorly in a spine, its whole inner margin is fringed with very long setæ.

External maxillipeds stout, the whole of the terminal joint and a good part of the penultimate joint also, reach beyond the tip of the antennal scale: their dorsal edge, like that of the 1st pair of thoracic legs behind the hand, is fringed with long setæ.

1st pair of legs very stout, almost the whole hand reaches beyond the antennal scale.

The 2nd pair of legs differ in the two sexes: in the adult *female* they are almost as long as the first pair, whereas in the adult male, and in the young, they reach but a very little way beyond the carpal articulation of the hand.

The 3rd pair surpass the 1st by almost their last two joints. Of the stout 4th and 5th pairs, the 5th reach nearly to, and the 4th a dactylus beyond, the antennal scale.

In the male the last 3 thoracic sterna are sharply carinated in the middle line: in the female the carination of the antepenultimate sternum is distinct, but that of the last two is obsolescent.

Length of carapace of egg-laden female 11 millim., that of the largest male 9 millim. Abdomen of egg-laden female 25 millim., that of the largest male 20 millim.

23 females, 21 males, and 45 young, were dredged, all in one haul, off Bombay in 56 to 58 fathoms.

Regd. Nos.  $\frac{3868-3890}{10}$  (Types of the species):  $\frac{3424-3429}{10}$ .

70. *Aegeon medium* (Alcock & Anderson).

*Pontocaris media*, Alcock and Anderson, Ann. Mag. Nat. Hist., April 1899, p. 282.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PL. XLI, FIG. 6.

Differs from *Aegeon affine* only in the following characters:—

(1) the rostrum reaches nearly to the end of the eyestalks, is dorsally grooved and is not cleft at tip, and has a larger spine on either side of its base:

(2) the supra-marginal carina on either side of the carapace is coarsely serrulate, or beaded:

(3) the first 5 abdominal pleura, though produced in a vertical direction, have blunt or truncated tips:

(4) the 2nd thoracic legs are of the same length in both sexes, not reaching far beyond the carpal articulation of the hand of the 1st pair:

(5) the last 3 thoracic sterna are more distinctly carinated in the female; but in the male they are not sharper than in *Ae. affine*.

As in *Ae. affine* the outer antennular flagellum, in the male only, is foliaceous up to a terminal filament.

The carapace in an adult female is 12 millim. long, in an adult male 9 millim. The abdomen in an adult female is 30 millim. long, in an adult male 22 millim.

From the Andaman Sea 55 and 60 fathoms.

The species is perhaps identical with *Pontocaris propensalata*, Bate.

Regd. Nos.  $\frac{2681-2683}{10}$  (Types of the species):  $\frac{3467}{10}$ .

## Subgenus PARAPONTOCARIS, nov.

Closely related to *Aegeon*, as restricted by Stebbing, from which it differs only in the following particulars:—

The integument, though extremely dense and hard, is not thick and coarse;

The abdominal pleura are produced antero-posteriorly and are rounded, instead of being produced in a vertical direction: the abdominal sterna are without a strong median spine.

The eyes are larger and blacker. The antennal scale is much longer than broad. The exopodite of the 1st pair of thoracic legs is larger.

The branchial formula is, however, exactly the same as that of *Aegeon cataphractus*, there being two branchiæ (one large, the other small and a good deal concealed) to the somite that carries the external maxillipeds.



*Synopsis of the (Indian) species of Parapontocaris.*

- I. The median carina of the 2nd abdominal tergum is bispinous: the lateral spine at the base of the rostrum is remote from the other two ... .. *P. andamanensis.*
- II. The median carina of the 2nd abdominal tergum is unispinous: of the three spines on either border of the rostrum the basal one is not very remote from the others ... .. *P. bengalensis.*

71. *Aegeon (Parapontocaris) andamanense* (Wood-Mason).

*Crangon andamanensis*, Wood-Mason, Ann. Mag. Nat. Hist., Nov. 1891, p. 360.

*Pontophilus andamanensis*, Ortmann, Proc. Ac. Nat. Sci. Philad. 1895, p. 182.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PL. IX. FIG. 2.

Rostrum reaching only to the end of the eyes: on either lateral border are three minute spines, one of which is at the base, while the other two are close together near the middle.

Orbital and post-antennal spines acute. All 7 carinae of the carapace are salient, the median being 5-, the dorsal 4-, the lateral 5 or 6-, and the marginal 3-toothed.

The abdominal carinae are salient and sharp. The 1st tergum has 6 carinae, all ending anteriorly in spines: the 2nd has 5, the median one of which is cut into two antrorse spines, while the one on either side of it ends anteriorly in a spine: the 3rd has 5, of which the median one alone extends to the posterior border: the 4th has 7, the median one alone being prominent and complete: the 5th has 6, the middle two of which are very sharp: the 6th has 4, the middle two of which are very prominent and are retrorsely 3 or 4-serrate. The 1st and 2nd abdominal pleura are very distinctly carinated near the edge: the 2nd pleuron being twice as long as deep. Tip of telson spinate.

Eyes broad, reniform. Antennular peduncle more than half the length of the antennal scale: antennular flagella unequal, the inner (about half of which lies beyond the antennal scale) being much longer than the outer and being remarkably setose, the outer one being bare: in the *male* the shorter outer flagellum is a little thicker, in the *female* it is vastly more slender, than the inner.

Antennal scale more than two-fifths the length of the carapace and rostrum (measured in the middle line), much longer than broad: its outer edge is thickened and ends anteriorly in a very acute spine, its inner edge with long setae.

The stout external maxillipeds reach, by half the length of their terminal joint, beyond the tip of the antennal scale; their dorsal border is thickly setose, as is that of the merus and carpus of the 1st pair of thoracic legs.

1st pair of thoracic legs stout, reaching a little beyond the antennal scale, even when the dactylus is flexed: the merus and the exceedingly short carpus each have a very strong spine at the far end of their ventral border.

The 2nd pair of legs, in both sexes, reach nearly halfway along the propodite of the 1st pair. The 3rd pair reach beyond the antennal scale by nearly their two terminal joints: there is a long acicular spine on the sternum between their bases. The 4th and 5th pair, which end in vertically-compressed, almost palmulate, dactyli, are of good length, the 4th pair reaching nearly to the tip of the antennal scale.

Colour in life chalky yellow, eyes dark.

The carapace of the largest female is 20 millim., the abdomen 50 millim., measured in the middle line.

Andaman Sea, 173, 185, 188-220 fathoms.

Regd. Nos.  $\frac{6771-6773}{9}$  and  $\frac{6775}{9}$  (Types of the species):  $\frac{24}{7}$ :  $\frac{2170}{10}$ .

## 72. *Aegeon (Parapontocaris) bengalense* (Wood-Mason).

*Crangon bengalensis*, Wood-Mason, Ann. Mag. Nat. Hist., Nov. 1891, p. 360: Alcock and Anderson, J. A. S. E. Vol. LXIII. 1894, pt. 2, p. 152.

*Pontophilus bengalensis*, Ortmann, Proc. Ac. Nat. Sci. Philad., 1895, p. 182.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE IX, FIG. 1.

Differs from *Ae. andamanense* only in the following particulars, as far as the female is concerned, the male being unknown:—

The rostrum reaches a good way beyond the eyes, and the three spines on either edge are larger, the one at the base being not decidedly remote from the others:

the lateral carinae of the carapace are only 3-toothed, and the supra-marginal carinae are only 2-toothed:

the median carina of the 2nd abdominal tergum is unispinous; all the carinae of the 3rd and 4th abdominal terga, except the median one, are very indistinct; the two middle carinae of the 6th tergum have only one retrorse tooth besides the terminal one.

An egg-laden female has the carapace 13.5 millim. long, the abdomen 30.5 millim. long, measured in the middle line.

Bay of Bengal, 145-250, 240-276, 272 fathoms.

Regd. Nos.  $\frac{6777}{9}$  (Type of the species):  $\frac{4263}{7}$ :  $\frac{6284-6285}{9}$ :  $\frac{9218}{9}$ .

## PRIONOCRANGON, Wood-Mason.

*Prionocrangon*, Wood-Mason, Ann. Mag. Nat. Hist., Nov. 1891, p. 361: Ortmann, Proc. Ac. Nat. Sci. Philad. 1895, pp. 175, 188.

Body compressed: carapace short, with a median carina; rostrum short: integument thin.

Eyes and eyestalks absent or represented by a pair of microscopic tubercles on the anterior edge of the exposed anterior somite.

Antennules distinctly dorsal of the antennæ. Antennular peduncle very long and slender, the basal joint with a small sharp tubercle at the base of its outer margin: flagella two in number, of fair length.

Antennal scale long, acute, styliform.

Exopodites of the maxillipeds small, unusually slender, their flagella not strongly bent inwards.

The 1st pair of thoracic legs, though the stoutest of all, are not very massive: they are subchelate, the edge against which the dactylus folds being more longitudinal than oblique.

The 2nd-5th legs are monodactylous, the dactyli being minute: the 3rd pair are very slender, the others are stout.

The endopodites of the first 5 abdominal appendages are almost rudimentary.

The gills are five on either side, being pleurobranchiæ and being attached to the last 5 thoracic somites.

73. *Prionocrangon ommatosteres*, Wood-Mason.

*Prionocrangon ommatosteres*, Wood-Mason, Ann. Mag. Nat. Hist., Nov. 1891, p. 362: Alcock and Anderson, J. A. S. B. Vol. LXIII. 1894, pt. 2, p. 152: Ortmann, Proc. Ac. Nat. Sci. Philad. 1895, p. 189.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE IX. FIG. 4.

Carapace from a third to two-sevenths the total length, its median carina, which extends to within a short distance of the posterior border, 6 or 7-toothed.

Though the eyes and eyestalks are wanting, there is a fairly well pronounced orbital notch, defined externally by a tooth: the post-antennal spine reaches further forwards than the tip of the rostrum. The rostrum is short, sharp, and ascendant.

Abdomen smooth: telson blunt-pointed, hardly as long as the 6th abdominal somite.

Antennular peduncle more than three-fourths the length of the carapace, measured in the middle line, by far the greater part of its extent being formed by the first joint: the flagella, which are slender and of nearly equal length, are as long as the long first joint.

The styliform antennal scale is half as long as the carapace.

The stout external maxillipeds reach a little beyond the tip of the antennular peduncle, and are thickly setose along the dorsal border.

The 1st pair of legs do not reach to the tip of the antennular peduncle and are not setose. The 2nd pair of legs end in a minute dactylus hidden in setæ, and do not reach halfway along the propodite of the first pair. The very slender 3rd pair reach to the tips of the external maxillipeds. The 4th and 5th pair are setose, the 4th pair, which reach to the tips of the 2nd pair, being a good deal longer than the 5th pair.

Length of carapace 8.5 millim., of abdomen 22.5 millim. measured in the middle line.

Andaman Sea, 405 fathoms, Bay of Bengal off the Ceylon coast 200-350 fathoms.

Regd. Nos.  $\frac{6744}{9}$  and  $\frac{9275}{9}$  (Types of the species).

#### Family *Glyphocrangonidae*, S. I. Smith.

*Glyphocrangonidae*, S. I. Smith, Report. U. S. Fish. Comm. for 1882 (1884), p. 364.

Body not compressed, integument very thick and rigid. Rostrum long, sharp, more or less recurved, dorsally flattened, armed laterally with spines. Carapace short, subcylindrical, sculptured, with either its branchiostegal or hepatic spines produced and wing-like.

Abdomen usually sculptured; its pleura narrow, vertically produced, and with one or both angles acute or spiniform. The first four abdominal somites interarticulate by means of little shallow ball-and-socket joints, situated on either side at the junction of tergum and pleuron. The last two abdominal segments and the telson interarticulate by means of special ratchet-joints situated on either side at the junction of tergum and pleuron, the mortise of each joint being in the posterior border, the tenon being on the anterior border of the somites: moreover, the recurved lower lip of the mortise is itself dovetailed into a notch in the base of the tenon, so that in extreme extension the joint is firmly locked. The telson is a strong sharp tapering segment, longer than the caudal swimmerets and quadrate in transverse section.

Eyestalks short. The antennular peduncle is slender, and supports two short flagella, the outer of which, more especially in the male, is expanded in its basal part: the basal joint of the peduncle is hollowed for the eye and has the proximal end of its outer margin slightly expanded to form the rudiment of a "scale." The antennal scale is broad, oval, and usually has a thickened midrib, its outer edge being thin and rarely ending in a spinule.

Mandibles slender, not cleft into divaricating incisor and molar branches, not furnished with a palp. The coxa of the 1st maxillæ and 1st maxillipeds,



and the coxa and basis of the 2nd maxillæ, are much reduced. The exopodites of all the maxillipeds end in slender flagella. The terminal joint of the 2nd maxillipeds articulates as usual along the distal part of the inner border of the propodite as if it were a complementary piece of that segment.

The external maxillipeds are pediform and stout: their dactylus is thickly beset with movable spines: two processes of their coxopodite together form a sort of collar, which firmly catches a process of the neighbouring margin of the carapace.

No exopodites are present on any of the thoracic legs.

The 1st pair of thoracic legs, which are stouter and shorter than the others, are sub-chelate and have the antero-internal angle of the ischium acutely produced: the short claw-like dactylus folds against the setose dorsal border of the propodite, but there is no spine there to serve as a fixed finger: the propodite is much broader at base than at tip.

The 2nd pair of legs are minutely chelate and have a flexible multi-articulate carpus.

The last three pairs of legs, which are similar in size and stoutness, are a little stouter than the 2nd pair.

All the abdominal appendages are biramous, and their endopodites (except in the first pair of the female) have a styliform internal appendix at base: in the second pair of the male there are two such lobes.

Eggs few and large.

The *Glyphocrangonidæ* of these seas fall into two groups as follows:—

- |     |  |     |     |     |                |
|-----|--|-----|-----|-----|----------------|
| I.  | The eyes are large and deeply pigmented (purple in spirit): there are 11 branchiæ on either side     | ... | ... | ... | GLYPHOCRANGON. |
| II. | The eyes are small and unpigmented (pale yellow in spirit): there are only 9 branchiæ on either side | ... | ... | ... | PLASTOCRANGON. |

#### GLYPHOCRANGON, A. Milne Edwards.

*Glyphocrangon*, A. Milne Edwards, Ann. Sci. Nat., Zool., (6) XI. 1881, p. 3: S. I. Smith, in Report U. S. Fish. Comm. for 1882, p. 364: Spence Bate, Challenger Crustacea Macrura, p. 503.

*Rhacocaris*, S. I. Smith, Bull. Mus. Comp. Zool. X. 1882-83, p. 41.

Cervical and gastro-hepatic grooves broad and deep. Besides a fine supra-marginal crest, running from the anterolateral or branchiostegal spine to the posterior border, and besides three incomplete longitudinal ridges on the infero-lateral aspect of the carapace, the carapace has, on either side, 4 prominent longitudinal ridges. The 1st or uppermost of these—the “dorsal” crest—runs from the posterior border of the carapace, to the base of the rostrum, and is usually serrated: the 2nd, or “subdorsal” crest, which also is usually in whole

or part serrated, runs from the posterior border to the cervical groove, and thence inclines towards the base of the rostrum: the 3rd, or "dorso-lateral" crest, runs from the posterior border to the cervical groove, and either ends there or is continued on to the orbital spine: the 4th, or "lateral" crest, runs from the posterior border to the cervical groove, and thence is continued, along the hepatic region, either to a point between the orbital and branchiostegal spines, or to the branchiostegal spine itself.

The abdomen is more or less distinctly carinated in the middle line, the carinae behind the first somite being broken.

Eyes globular, very large, generally dark purple in spirit specimens.

The branchial formula is as follows:—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.	Pleurobranchiæ.		
VII	ep.	0	0	=	ep.
VIII	ep.	0	0	=	ep.
IX	0	2	0	=	2
X	0	1	1	=	2
XI	0	1	1	=	2
XII	0	1	1	=	2
XIII	0	1	1	=	2
XIV	0	0	1	=	1
Total	(2 ep.)	6	5	=	11 + 2 ep.

*Key to the species of Glyphocrangon of the Indian Benthos.*

I. The 3rd or "dorso-lateral" crest of the carapace is present behind the cervical groove only:—

1. The anterior half of the 4th or "lateral" crest ends in a huge, vertically-compressed wing-like spine, the tip of which projects beyond the anterior border of the carapace between the orbital and branchiostegal spines:—

i. Free portion of rostrum about two-thirds the length of the rest of the carapace measured in the middle line: the 3rd or "dorso-lateral" crest does not end acutely: the 2nd pair of thoracic legs are at least as long as those behind them ... ..

*G. investigatoris.*

ii. Free portion of rostrum more than two-thirds the length of the carapace: the 3rd or "dorso-lateral" crest ends in a spine: the 2nd pair of thoracic legs are decidedly shorter than those behind them ... ..

*G. Smithii.*

2. The anterior half of the "lateral" crest ends in a small spine which falls far short of the anterior border of the carapace:—

i. 2nd or "subdorsal" crest sharply serrated in all its course: anterior half of 4th or "lateral" crest cut into two teeth: median carinae of 2nd and 3rd abdominal terga prominent ... ..

*G. priononota*

- ii. 2nd or "subdorsal" crest smooth in its posterior half: anterior half of 4th or "lateral" crest smooth up to its terminal spine: carinæ of 2nd and 3rd abdominal terga low and inconspicuous ... *G. unguiculata*.
- II. The 3rd or "dorso-lateral" crest of the carapace is present, not only behind the cervical groove, but also in front of it as a post-antennal ridge:—
1. The anterior half of the 3rd or "dorso-lateral" crest runs forward to and ends in the orbital spine: antennal scale not nearly twice as long as broad ... .. *G. hastacauda*.
  2. The anterior half of the 3rd or "dorso-lateral" crest ends in a small spine behind and distinct from the orbital spine: antennal scale twice as long as broad ... .. *G. Gilesii*.

#### 74. *Glyphocrangon investigatoris*, Wood-Mason.

*Glyphocrangon investigatoris*, Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 191; and var. *andamanensis*, id. ib., Nov. 1891, p. 356.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE VI. FIGS. 3, 2.

The rostrum is traversed longitudinally by a very fine median posteriorly-serrated ridge, and is armed on either border with 2 spines, one at the base, the other near the middle; the length of its free portion is about two-thirds that of the rest of the carapace measured in the middle line; its base is separated from the gastric region by a groove.

Except that the anterior half of the 3rd or "dorso-lateral" crest is utterly wanting, all the crests of the carapace are thick and prominent, and the surface between them—like that of the abdominal terga and pleura—is studded with very numerous tubercles which have a tendency to be compressed and to fall into lines parallel with the crests. Amid these tubercles the anterior half of the 2nd, or "subdorsal," crest of the carapace is obscured.

The orbital and branchiostegal spines are very large and acute, and behind and between them is the huge vertically-compressed wing-like spine in which the lateral crest of the carapace ends, this crest having no other spine in any part of its course. Nor are there any other distinct spines on any of the other crests of the carapace, though the dorsal and subdorsal crests are coarsely serrated in all their extent. The other crests of the carapace, though smooth to the naked eye, have, under the lens, a "worm-eaten" edge.

The 1st abdominal tergum has three short, anteriorly acute, carinæ—one median, and one on either side.

The 2nd to the 6th abdominal terga have each a median carina, which is divided by a deep notch into two more or less unequal lobes or teeth, and on the 5th tergum the posterior half of the carina is trifurcate.

All four edges of the telson are very salient and are serrulate at their proximal end: the median carina of the abdomen is represented on the telson at its extreme proximal end only.

The free ends of the abdominal pleura, from the 2nd to the 5th, show as a pair of strong sharp recurved spines, the anterior of which is the larger in the case of the 2nd, 3rd and 4th pleura: the pleuron of the 6th somite ends in a single recurved spine.

Eyes large, globular, vastly wider than their stalks, of a brownish-purple colour in spirit.

The antennular peduncle projects a short way beyond the antennal scale: the inner antennular flagellum, which is longer and slenderer than the outer, is hardly longer than the peduncle: the outer flagellum in the male is much thickened up to its filamentous tip, but is not foliaceous.

The antennal scale is broadly oval, its breadth being more than three-fifths its length: the antennal flagellum is as long as the distance between the tip of the rostrum and the after edge of the 3rd abdominal tergum.

The external maxillipeds reach the tip of the antennal scale and are little less stout than the 1st pair of thoracic legs.

The 1st pair of legs, with the dactylus extended, reach to the end of the penultimate joint of the external maxillipeds.

The 2nd pair of legs, which reach beyond the antennal scale by more than a third of their carpus, are at least as long as any of the last 3 pairs.

In the last two pairs of legs the propodite ends in a brush of setæ, and the dactylus is vertically compressed, dorsally grooved, and lanceolate.

The colours in life are variable. In the type they were recorded as "old ivory white, with orange-white markings on tips of spines, etc.; the eyes are magenta." In the variety *andamanensis* the colours, according to my own observation, were pink and the eggs pea-green.

In a large female the carapace and rostrum are 51 millim. long and the abdomen is 66 millim., measured in the middle line.

A very common species: found in the Bay of Bengal at 145-250, 193, 272, 281-258, 410, and 594-225 fathoms; in the Arabian Sea at 142-400, 360, 480, 295-360, and 595-556 fathoms; and in the Andaman Sea at 188-220 and 405 fathoms.

Regd. Nos.  $\frac{6231}{9}$  (Type of the species):  $\frac{4233-4241}{7}$ :  $\frac{6232-6233}{9}$ :  $\frac{6732-6733}{9}$ :  $\frac{8851-8854}{9}$ :  
 $\frac{1396-1398}{10}$ :  $\frac{1943-1944}{10}$ :  $\frac{3411-3412}{10}$ :  $\frac{3821}{10}$ :  $\frac{3825}{10}$ :  $\frac{3836-3842}{10}$ :  $\frac{3851}{10}$ :  $\frac{3859}{10}$ .



75. *Glyphocrangon Smithii*. Wood-Mason.

*Glyphocrangon Smithii*, Wood-Mason, Ann. Mag. Nat. Hist., Nov. 1891, p. 357.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE VII, FIG. 3.

Differs from *G. investigatoris* only in the following particulars:—

The length of the free portion of the rostrum is more than four-fifths that of the rest of the carapace measured in the middle line, and the anterior of the lateral spines of the rostrum is a good way behind the middle: the anterior half of the rostrum is foveolate dorsally on either side of the very faint median longitudinal ridge.

The 3rd or dorso-lateral crest of the carapace ends in a small spine.

The tubercles between the crests of the carapace are very much smaller and less numerous, in fact are mere granules which, on the lateral regions especially, are quite inconspicuous. On the abdominal terga also they are less numerous, and on the abdominal pleura more confluent.

The antennular peduncle hardly reaches beyond the antennal scale, and the antennular flagella are longer.

The second pair of thoracic legs are decidedly shorter than any of the last three pairs, and reach only to the end of the antennal scale.

Colour in life bright crimson.

Length of carapace and rostrum 34 millim., of abdomen 42 millim.

Bay of Bengal, near the Andamans, 561 fathoms; Andaman Sea, 188–220 fathoms; Arabian Sea, off the Maldives, 459 fathoms.

Regd. Nos.  $\frac{6734}{9}$  (Type of the species) :  $\frac{6733}{9}$  :  $\frac{1402}{10}$ .

76. *Glyphocrangon priononota*, Wood-Mason.

*Glyphocrangon priononota*, Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 192.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE VI, FIG. 1.

Differs from *G. investigatoris* only in the following particulars:—

The free portion of the rostrum is more than three-fourths the length of the rest of the carapace measured in the middle line, and the anterior of the lateral spines of the rostrum is a good way behind the middle.

The crests of the carapace are thinner, and the tubercles between them are very much smaller and less numerous, being little more than scattered granules.

The 2nd or “subdorsal” crest of the carapace is as distinct in its anterior as it is in its posterior half, and is sharply serrated throughout, its spines being compressed and the front one being larger than the rostral spines.

The 4th or "lateral" crest in its anterior half is cut into two spines, the anterior and larger of which does not nearly reach to the anterior border of the carapace.

Though in the female the inner and longer antennular flagellum is about as long as its peduncle and about half the thickness of the outer flagellum, yet in the male both flagella are about half as long again as the peduncle, and the outer one is foliaceously expanded in its proximal two-thirds.

The antennal scale is narrower, its breadth being little more than half its length, and the antennal flagellum is a little longer than the distance between the tip of the rostrum and the after border of the 3rd abdominal somite.

The 2nd pair of thoracic legs are shorter than any of the last 3 pairs and reach only a short distance beyond the tip of the antennal scale.

Colour in life, deep pink or orange, the eyes dull orange with an opalescence like a "cat's-eye."

A large female has the carapace and rostrum 50 millim. long and the abdomen 65 millim., measured in the middle line.

Found in the Arabian Sea only, in the neighbourhood of the Laccadives and northwards, at 865-880, 890, 912-931, 947, 1000, and 1022 fathoms.

Regd. Nos.  $\frac{6026}{9}$  and  $\frac{6028}{9}$  (Types of the species) :  $\frac{8850}{9}$  :  $\frac{30}{10}$  :  $\frac{32}{10}$  :  $\frac{34-38}{10}$  :  $\frac{796-797}{10}$  :  $\frac{3418-3419}{10}$ .

## 77. *Glyphocrangon unguiculata*, Wood-Mason.

*Glyphocrangon unguiculata*, Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 193.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE VII. FIG. 2.

Differs from *G. investigatoris* in the following characters:—

The length of the free portion of the rostrum is more than three-fourths that of the rest of the carapace measured in the middle line; the anterior of the lateral spines is well abaft the middle, and the median dorsal ridge is hardly distinguishable.

Between the crests of the carapace there are only a few small scattered granules, and these are hidden by the fine deciduous velvety pile by which the surface of the carapace is covered.

The "dorsal" and the ill-defined anterior half of the "subdorsal" crests are rugulose or bluntly crenulate, but all the other crests of the carapace are smooth.

The anterior half of the "subdorsal" crest ends anteriorly in a small spine, as also does the anterior half of the 4th or "lateral" crest, the latter spine not reaching anywhere near the anterior border of the carapace.

The sculpture of the abdominal terga consists of low blunt "worn" ridges, in more or less distinctly longitudinal series. The carinæ of the 2nd and 3rd and of the anterior half of the 4th terga are low, blunt, and "worn."

In the male the antennular flagella are a good deal longer than their peduncle, and the outer flagellum is almost foliaceous in its proximal three-fourths.

The length of the antennal scale is twice its breadth: the antennal flagellum is as long as the distance between the tip of the rostrum and the middle of the telson.

The external maxillipeds do not quite reach the tip of the antennal scale.

The 2nd pair of thoracic legs are shorter than any of the last 3 pairs. The dactyli of the 4th and 5th pair of legs have the outer margin produced as a microscopic incurved claw.

Colour in life, delicate pink.

In an adult female the length of the carapace and rostrum is 37 millim., of the abdomen 51 millim., measured in the middle line.

Found only in the Arabian Sea, in the neighbourhood of the Laccadives and northwards, at 740, 770, 824, and 947 fathoms.

Regd. Nos.  $\frac{6024}{9}$  and  $\frac{52}{10}$  (Types of the species):  $\frac{51}{10}$ :  $\frac{53-54}{10}$ :  $\frac{1403}{10}$ :  $\frac{2356}{10}$ .

### 78. *Glyphocrangon hastacauda*. Spence Bate.

*Glyphocrangon hastacauda*, Spence Bate, Challenger Macrura. p. 519, pl. xciii. fig. 5: Alcock and Anderson, Journ. Asiatic Soc. Bengal, Vol. XLIII. pt. 2, 1894, p. 151.

Differs from *G. investigatoris* in the following points:—

The anterior half of the 3rd or "dorso-lateral" crest is present, forming a post-antennal crest continuous with the pre-eminently large vertically-compressed antennal or orbital spine.

The anterior half of the "subdorsal" crest, the posterior portion of the "dorso-lateral" and "lateral" crests, and the anterior half of the "lateral" crest all end anteriorly in small spines, the spine of the last named crest not approaching the anterior border of the carapace.

The "dorsal" and anterior half of the "subdorsal" crests are crenulate but all the other crests are smooth to the naked eye.

The surface of the carapace between the crests is smooth and is covered with a fine deciduous pile.

The dorsal surface of the abdomen is merely wrinkled and dimpled, and the abdominal carinæ, though corresponding exactly with those of *G. investigatoris* in position and number, are lower and blunter, especially on the anterior somites.

The length of the free portion of the rostrum is more than three-fourths that of the rest of the carapace measured in the middle line, and the median dorsal ridge is so fine as to be hardly distinguishable.

The antennal scale is not so broadly oval, its breadth being about four-sevenths its length.

The external maxillipeds do not reach the tip of the antennal scale.

The 2nd pair of thoracic legs are shorter than any of the last 3 pairs and do not reach the tips of the external maxillipeds.

Colour in life, pale salmon red.

In the largest specimen the carapace (rostrum included) is 33 millim. in length, the abdomen 42 millim., measured in the middle line

Bay of Bengal, off Ceylon, 594-225, and 609 fathoms. The Challenger specimens were dredged off Japan.

Regd. Nos.  $\frac{9220}{9}$  :  $\frac{3822-3824}{10}$ .

### 79. *Glyphocrangon Gilesii*. Wood-Mason.

*Glyphocrangon Gilesii*. Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 193.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE VII, FIG. 4.

Differs from *G. investigatoris* in the following points:—

The anterior half of the 3rd or dorso-lateral crest of the carapace is present as in *G. hastacauda*, but instead of being continuous with the pre-eminently large orbital spine, as it is in *G. hastacauda*, it ends in a small spine lying immediately behind the orbital spine.

The anterior half of the 2nd or "subdorsal" crest is broken up into from 2 to 4 teeth of which only the front one is acute, and the anterior half of the 4th or "lateral" crest ends in a small spine; but, except for this, all the crests of the carapace are smooth to the naked eye.

The surface between the crests of the carapace is perfectly smooth and dead-polished.

The dorsal surface of the abdomen is merely wrinkled, though the last two somites are more deeply rugose. The abdominal carinæ, though corresponding with those of *G. investigatoris*, are much lower and blunter, being quite inconspicuous on the 2nd, 3rd and anterior half of the 4th somites.

The free portion of the rostrum is more than three-fourths the length of the rest of the carapace measured in the middle line: the median dorsal ridge of the rostrum is indistinguishable.

The antennal scale is elongate-oval, its length being twice its breadth.

The external maxillipeds do not reach the tip of the antennal scale. The



2nd pair of legs are shorter than those behind them and hardly reach the tip of the antennal scale.

In an egg-laden female the carapace (rostrum included) is 30 millim., the abdomen 41 millim. long, measured in the middle line.

Found only in the Andaman Sea, at 370-419, 405, 490, and 500 fathoms.

This species very closely resembles *G. hastacauda*, but can be at once distinguished (1) by the fact that the anterior part of the 3rd or dorso-lateral crest of the carapace ends behind the orbital spine instead of being continuous with it, and (2) by the elongate-oval antennal scale.

Regd. Nos.  $\frac{8522}{6}$  (Type of the species) :  $\frac{1399-1401}{10}$  :  $\frac{2357}{10}$  :  $\frac{2514-2515}{10}$ .

Subgenus *PLASTOCRANGON*, *nov.*

Differs from *Glyphocrangon* only in the following particulars:—

The eyes are small and in life are of an opaque yellow-ochre colour, in spirit they are of the same neutral tint as the carapace. The dorsal and subdorsal crests of the carapace are broken up into lines of tubercles. The branchiæ are only 9 on either side, arthrobranchiæ being absent from the Xth and XIth somites: otherwise the branchial formula is as in *Glyphocrangon*.

*Synopsis of the Indian species of the subgenus Plastocrangon.*

- I. The anterior half of the 4th or "lateral" crest of the carapace ends in a huge vertically-compressed wing-like spine, lying behind and external to the branchiostegal spine, and projecting far beyond the anterior border of the carapace:—
  1. The anterior half of the 4th or "lateral" crest of the carapace has no spine but the large spine aforesaid: posterior half of 3rd or "dorso-lateral" crest entire ... .. *P. cæca.*
  2. The anterior half of the 4th or "lateral" crest of the carapace is cut into two portions, the anterior of which is the large spine aforesaid: posterior half of 3rd or "dorso-lateral" crest cut into two lobes ... .. *P. cerea.*
- II. The anterior half of the 4th or "lateral" crest of the carapace is cut into two small teeth, the anterior of which falls far short of the anterior border of the carapace. Abdominal terga and pleura crisply sculptured ... .. *P. cæcescens.*

80. *Glyphocrangon (Plastocrangon) cæcescens*, Wood-Mason.

*Glyphocrangon cæcescens*, Wood-Mason, Ann. Mag. Nat. Hist., Nov. 1891, p. 357.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE VII, FIG. 5.

The rostrum, the length of the free portion of which is nearly equal to that of the rest of the carapace measured in the middle line, is traversed dorsally by

a fine median ridge and is armed on either border with *three* spines—two close together near the base, the third in front of the eyes; its base is separated from the gastric region by a transverse groove.

All the crests of the carapace, except the anterior portion of the 3rd or “dorso-lateral,” are present and are crenulate or coarsely serrate, but the “dorsal” and the anterior half of the “subdorsal” crests are a good deal lost sight of in the general crisp tuberculation of the dorsum of the carapace. The abdominal terga and pleura are similarly crisply tubercled.

The anterior half of the “lateral” crest is cut into two small teeth, the anterior of which lies immediately behind the pre-eminently large branchiostegal spine.

The abdomen is carinated in the middle line exactly as in *G. investigatoris*. The pleura of the 1st abdominal somite end in a sharp procurved tooth; those of the 2nd and 5th somites have their anterior and posterior angles dentiform on either side of a median spine; those of the 3rd and 4th somites end each in two recurved spines, of which the anterior is the larger; those of the 6th somite end in a single large recurved spine. The telson is as in *G. investigatoris*.

The eyes are of moderate size their major diameter being contained  $4\frac{1}{2}$  times in the length of the free portion of the rostrum: in spirit they are of the same colour as the integument.

The antennular peduncle reaches only to the tip of the antennal scale: the inner flagellum, which is much the more slender and slightly the longer, is about as long as the peduncle.

The antennal scale is elongate-oval, its length being slightly more than twice its breadth: the antennal flagellum is a little longer than the carapace and rostrum.

The external maxillipeds are as stout as the 1st pair of legs and do not reach the tip of the antennal scale.

The 1st pair of legs, with the dactylus extended, reach to the end of the penultimate joint of the external maxillipeds.

The 2nd pair of legs, which are shorter than the 3 pairs behind them, do not reach the tips of the external maxillipeds. The dactyli of the last 2 pairs of legs spring, as usual, from a brush of setæ at the end of the propodites, and have their outer edge produced to form a small incurved claw.

Colour in life pale pink, eyes dull yellow.

In the unique specimen the carapace (rostrum included) is 28 millim. long, the abdomen 38 millim. long, measured in the middle line.

From the Bay of Bengal, 1748 fathoms.

Regd. No.  $\frac{6736}{9}$  (Type of the species).

81. *Glyphocrangon (Plastocrangon) caeca*, Wood-Mason.

*Glyphocrangon caeca*, Wood-Mason, Ann. Mag. Nat. Hist., Nov. 1891, p. 358.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE VII, FIG. 1.

The rostrum, the free portion of which is about three-fifths the length of the rest of the carapace measured in the middle line, is traversed dorsally by a fine median ridge, on either side of which, anteriorly, is a row of pits, most distinctly impressed in the male. The two usual teeth are present on either border, the posterior being rather blunt. The transverse groove that separates the rostrum from the gastric region is faint. *Orbital spine very small.*

Of the crests of the carapace, all of which except the anterior half of the 3rd or "dorso-lateral" crest are present, the "dorsal" and "subdorsal" are represented by rows of tubercles, and all the others are smooth. The anterior half of the 4th or "lateral" crest ends in a huge vertically-compressed wing-like spine, lying outside the branchiostegal spine and projecting far beyond the anterior border of the carapace: behind and above this spine is a smooth oval hepatic swelling. The surface between the crests of the carapace is smooth except for a double row of granules lying between the "dorsal" crests in their anterior or gastric portion, and for a few granules defining certain parts of the cervical groove.

The abdomen is carinated in the same general way as in *G. investigatoris*, but the carinae are all less sharply cut, those of the 2nd, 3rd and anterior half of 4th terga are obsolescent, and that of the 6th tergum is not divided into two parts by a notch. Except for some oblique crests on the 5th and 6th terga, and for some small low tubercles lying in a longitudinal series on either side of the median carina, the abdominal terga are smooth.

The eyes are small, their major diameter being contained from 4 to 5 times in the length of the free portion of the rostrum, and they may be unequal: in spirit they are the same colour as the rest of the integument.

The antennular peduncle does not reach the tip of the antennal scale: the flagella are much longer than the peduncle, especially in the male, in which sex also the outer flagellum is foliaceously expanded in its proximal half.

The antennal scale is broadly oval, its breadth being more than two-thirds its length, and its dorsal surface is finely hispid.

The external maxillipeds are slightly stouter than the 1st pair of legs and reach to the middle of the antennal scale.

The 1st pair of legs, with the dactylus extended, hardly reach the end of the penultimate joint of the external maxillipeds. The 2nd pair of legs are shorter than those behind them, and almost reach the tip of the antennal scale: they are distinctly longer in the male than in the female.

Colour in life bright pink, eyes dull yellow.

In an egg-laden female the carapace (rostrum included) is 25 millim. the abdomen 38 millim. in length, measured in the middle line.

Bay of Bengal, near the Andamans, 561 fathoms.

Regd. No.  $\frac{6737}{9}$  (Types of the species):  $\frac{6739}{9}$ .

82. *Glyphocrangon (Plastocrangon) cerea*. Alcock & Anderson.

*Glyphocrangon cerea*, Alcock & Anderson, Journal Asiatic Society of Bengal, Vol. LXIII, pt. 2, 1894, p. 151.  
ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE IX. FIG. 76.

Closely related to *G. cæca*, from which it differs only in the following particulars:—

The rows of tubercles representing the “dorsal” and “subdorsal” crests of the carapace are blunter and less distinct: the double row of granules lying between the anterior or gastric portions of the “dorsal” crests are almost obsolete, and no granules define the cervical groove posteriorly.

The “dorso-lateral” crest, instead of being entire, is divided into two blunt lobes. The anterior part of the “lateral” crest, though it ends in a huge vertically-compressed wing-like spine as in *G. cæca*, is interrupted immediately behind that spine.

Three low swellings on its anterior margin represent the three carinæ of the 1st abdominal tergum; the 2nd and 3rd terga have no trace whatever of a median carina; the 4th, 5th and 6th terga are carinated in the same general fashion as in *G. investigatoris*, but, as in *G. cæca*, the carinæ are less sharply cut and that of the 6th tergum is not divided into two lobes.

Except for these median carinæ and for some lateral sculpturing on the 5th and 6th somites, the abdomen is smooth.

The pleura of the 5th abdominal somite end, like those of the 6th, in a single recurved tooth.

The major diameter of the eyes is not a sixth the length of the free portion of the rostrum. The antennal scale has a smooth dorsal surface and is three-fourths as broad as long.

The length of the carapace (rostrum included) of the largest specimen is 18 millim., that of the abdomen 27 millim., measured in the middle line.

Arabian Sea, between the Laccadives and Maldives, 719 fathoms.

Regd. Nos.  $\frac{8855-8856}{9}$  (Types of the species).



Family *Palæmonida*, Spence Bate.

Spence Bate, Challenger Crust. Macrura, pp. 481, 778; Stebbing, Hist. Crust., p. 246; Ortmann in Bronn's Thier Reich, Malacostraca, p. 1131.

Rostrum well developed. Antennular scale present: two long antennular flagella, the outer of which is split into two unequal filaments. Antennal scale of good breadth.

Mandible deeply cleft into incisor and molar processes and having a stout two- or three-jointed palp. Coxa and basis of the 1st maxillæ and 1st maxillipeds well developed, but not the coxa of the 2nd maxillæ. The terminal joint of the 2nd maxillipeds lies obliquely along the distal part of the inner border of the propodite, as if it were a complemental piece of the propodite. External maxillipeds pediform, the third joint (ischium-merus) curved outwards a little. The exopodites of all three pairs of maxillipeds are flagelliform, and lax.

1st and 2nd pairs of legs chelate, the 1st pair slender, the 2nd pair of pre-eminent size and with undivided carpus. Last 3 pairs of legs slender and of moderate length.

No exopodites to any of the thoracic legs.

Eggs small and numerous.

## BRACHYCARPUS, Spence Bate.

*Brachycarpus*, Spence Bate, Challenger Crust. Macrura, p. 795.

I would regard this as a subgenus of *Palæmon*, from which it differs (1) in the extremely short carpus of the 2nd pair of chelipeds, (2) in the shorter antennular flagella, and (3) in having a true hepatic, in place of a branchiostegal, spine.

Body only very moderately compressed. Rostrum of good length, serrated dorsally and ventrally. Carapace smooth, furnished with a post-antennular and a true hepatic spine only: outer orbital angle well defined but not acute. Abdominal pleura wide.

Eyes of good size and well pigmented. Antennular peduncle short, the basal joint thinned and broadened and slightly concave dorsally for the eye, the "stylocerite" acute; the flagella of moderate length, the outer, which is the stouter, is split into 2 filaments. Antennal scale fairly broad, the outer border thickened and ending acutely.

The 2nd pair of legs are much longer and stouter than any of the others and have a long hand and an extremely short carpus.

Abdominal appendages biramous, the endopodite of all from the 2nd to the 5th has the usual styliiform internal appendix. Exopodite of tail fan with a transverse suture.

The branchial formula is as follows:—

Somites and their appendages.	Podobranchiæ.	Arthrobranchiæ.	Pleurobranchiæ.	
VII	(ep.)	0	0	= ep.
VIII	(ep.)	0	0	= ep.
IX	(ep. r.)	1	0	= 1 + ep. r.
X	0	0	1	= 1
XI	0	0	1	= 1
XII	0	0	1	= 1
XIII	0	0	1	= 1
XIV	0	0	1	= 1
Total	2 ep. + ep. r.	1	5	= 6 + 2 ep. + ep. r.

### 83. *Palæmon (Brachycarpus) laccadivensis*, Alc. and And.

*Palæmonella laccadivensis*, Alcock and Anderson, Journ. Asiatic Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 157.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XXVI. FIG. 4.

Rostrum about half the length of the rest of the carapace measured in the middle line, upcurved, dorsally cristate and 9- or 10-serrate, ventrally cristate and 2-serrate.

Hepatic spine much larger than the postantennular.

6th abdominal somite nearly twice as long as 5th: telson as long as both combined, and equal in length to the elegantly-oval caudal swimmerets.

Eye a little wider than the stalk. The antennular peduncle reaches nearly three-quarters of the way along the antennal scale: its basal joint is the longest and has its outer border distally produced to form a spine similar in size and form to the "stylocerite." Antennal scale more than half as long as the carapace proper.

External maxillipeds slenderer and much shorter than any of the legs, not reaching halfway along the antennal scale.

The 1st pair of legs are the shortest of all, they reach beyond the antennal scale by their chelæ only.

The 2nd pair are much the longest and by far the most massive of all, and are unequal—one being longer and stouter than the other, the chief difference being in the length of the hand. The larger one is as long as the whole body without the rostrum, a good deal more than half its length being contributed by the hand: its palm, which is a stout subcylindrical joint, is about five times as long as the wrist and twice as long as the fingers: the fingers are hooked at tip and have the opposed edges channelled: the dactylus, which projects beyond the fixed finger, has at its base a large tooth which closes between two teeth on the fixed finger. The smaller one is a little longer than the abdomen, the hand forming a good deal less than half its length: its palm, which is slenderer than

its fellow, is about four times as long as the wrist and twice as long as the fingers: its fingers have much the same form as their fellows of the other side, but are slenderer and more nearly equal to one another in length.

The last 3 pairs are nearly of a length: the 3rd, which are very slightly longer than the 4th and 5th, reach a very little beyond the antennal scale: all end in a very stumpy claw-like dactylus, and all—like the first two pairs of legs—are quite smooth.

In the largest egg-laden female the length of the rostrum is 6.5 millim., of the carapace 12.5 millim., of the abdomen 30 millim., of the largest cheliped 42 millim., but there are two other egg-laden females not half this size.

Arabian Sea, near the Laccadives and Ceylon 406, 430 and 740 fathoms.

Regd. Nos.  $\frac{9221}{9}$  and  $\frac{2129-2130}{10}$  (Types of the species):  $\frac{4789}{7}$ .

### Family *Alpheidæ*, Spence Bate.

Spence Bate, Challenger Crust. Macrura, p. 528: Stebbing, Hist. Crust., p. 230: Ortmann, in Bronn's *Thier-Reich*, Malacostraca, p. 1127: Coutière, Ann. Sci. Nat., Zool. (8) IX. 1899.

Rostrum much reduced, the frontal margin of the carapace on either side of it produced so as to more or less cover the eyes, which have short stalks. Abdomen ending in a broad rounded-off telson.

Basal joint of the antennular peduncle with a scale on its outer margin. Antennal scale foliaceous.

Mandibles deeply cleft into incisor and molar processes, and with a short incurved two-jointed palp in the gap between these. 1st pair of maxillæ with coxa and basis well developed, and with an incurved palp. 2nd pair of maxillæ and 1st maxillipeds with coxa small, and basis well developed. All the maxillipeds with exopodites. Terminal segment of the 2nd maxillipeds as in the *Crangonidæ*.

1st pair of legs robustly chelate, usually asymmetrical: 2nd pair minutely chelate, with multiarticulate carpus. No exopodites to any of the thoracic legs.

Two species of this family are inhabitants of the depths of the Indian seas.

### ALPHEUS, Fabr.

*Alpheus*, Fabricius, Ent. Syst., Suppl., p. 404: Milne Edwards, Hist. Nat. Crust. II. 349: Coutière, Ann. Sci. Nat. Zool., (8) IX. 1899, p. 336.

Integument smooth. Carapace compressed, ending in a minute or short, compressed, non-serrated rostrum, on either side of which the frontal margin is produced to form a transparent convex roof that completely covers the eyes and the short, little-movable, eyestalks.

Abdomen stout, very slightly compressed, ending in a broad blunt telson on the dorsal surface of which are, commonly, two pairs of spines.

The basal joint of the antennules has on its outer edge a stout acute scale. Two antennular flagella, the outer of which is short and the inner long.

Antennal scale narrow, its outer edge thickened and ending acutely: antennal flagellum long.

[The 2nd pair of maxillipeds is seven-jointed as usual]. Exopodite of external maxillipeds small.

The 1st pair of legs are massive chelipeds differing in size and form on the two sides of the body, the hand of one side being often—especially in the male—gigantic.

Of the last 3 pairs of legs the 3rd and 4th are usually longer and stouter than the 5th.

Abdominal appendages biramous, the inner ramus of the 1st pair small: the endopodites of the 2nd–5th pairs have a small styliform process at their base, and in the male the 2nd pair has 2 such processes. The exopodite of the caudal fan consists of two segments.

The branchiæ are six pairs disposed as follows:—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.	Pleurobranchiæ.	
VII	(ep.)	0	0	= ep.
VIII	(ep.)	0	0	= ep.
IX	(ep.)	1	0	= 1 + ep.
X	(ep.)	0	1	= 1 + ep.
XI	(ep.)	0	1	= 1 + ep.
XII	(ep.)	0	1	= 1 + ep.
XIII	(ep.)	0	1	= 1 + ep.
XIV	0	0	1	= 1
Total	(7 ep.)	1	5	= 6 + 7 ep.

The 5 posterior epipodites end each in a curious little hook, and close to their point of origin there may be a pair of setæ of extraordinary length.

#### 84. *Alpheus macroceles*, Alcock and Anderson.

*Alpheus macroceles*, Alcock and Anderson, Journ. Asiatic Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 153: Coutière, Bull. Soc. Ent. France, 1898, No. 3, p. 31.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE IX. FIG. 5.

Integument thin but firm, smooth and polished. Rostrum slender, styliform, produced forwards a good way beyond the blunt supra-ocular lobes, and backwards between the eyes as a low obtuse carina.

Abdominal pleura a good deal produced vertically and only of moderate breadth fore and aft; those of the 2nd somite only very slightly overlap those of the 1st and 3rd somites.



The 2nd joint of the antennular peduncle is much the longest: the inner antennular flagellum is extremely slender, the distal end of the thickened basal portion of the outer flagellum is fringed with long silky setæ.

The larger cheliped in the male is longer than the entire body and *for an Alpheus* is slender; not quite three-fifths of its length is contributed by the hand. The arm, which has a spine near the far end of the upper border and a series of distant finely-acicular movable spinelets along the inner border, is about two-thirds of the length, and more than half the thickness, of the palm. The palm, which is slender subcylindrical and gently tapering, is as long as the combined carapace and 1st abdominal somite. The dactylus, which is decidedly shorter than the fixed finger, is only about one-third the length of the palm, and is furnished with a small tubercle that fits into a round hole in the opposable edge of the fixed finger.

In the smaller cheliped the palm is hardly half the length of the carapace and is equal in length to the fingers, which are long slender and hooked at tip.

The slender 2nd pair of legs reach, by their chelæ and last 2 segments of the five-jointed carpus, beyond the carpal articulation of the hand.

Although the number and arrangement of the branchiæ is typical, and although the gill-elements are arranged in two series on either side of a stem as in typical phyllobranchiæ, yet the gill-elements are narrow thick filaments and not thin broad plates, so that the gills have a lax and feathery appearance.

Colour in life, transparent blood red.

In the largest male the carapace is 14 millim. long, and the abdomen 24 millim., measured in the middle line, and the larger cheliped 41 millim. An egg-laden female is a good deal smaller.

From the Bay of Bengal, 193, 145–250, and 270 fathoms, and from the Andaman Sea, 188–220 fathoms.

Regd. Nos.  $\frac{8857}{9}$  (Type of the species):  $\frac{4243-4244}{7}$ :  $\frac{6283}{9}$ :  $\frac{6759-6760}{9}$ .

### 85. *Alpheus Shearmeri*, Alcock and Anderson.

*Alpheus Shearmeri*, Alcock and Anderson, Ann. Mag. Nat. Hist., April 1899, p. 283.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLI. FIG. 4.

Integument very thin but firm, smooth and polished. Rostrum minute, not longer than the equally acute supra-ocular spines, not produced backwards as a carina.

Abdominal pleura broad fore and aft and broadly rounded; those of the 2nd somite widely overlap those of the 1st and 3rd somites.

The first joint of the antennular peduncle is the longest; the antennular flagella are not setose.

The larger cheliped, which alone is present in the unique specimen, is as long as the abdomen: more than three-fourths of its length is contributed by the enormously enlarged hand, all the other joints being excessively slender. The dactylus, which is longer than the fixed finger, is about half the length of the palm: it has one tooth at its basal end and the fixed finger has two, but the socket in the fixed finger and the plug-like tubercle of the dactylus, that fits into it, which are present in most species of *Alpheus*, are *entirely wanting*. The palm is grooved along the inner aspect of the upper border up to a terminal notch behind the finger-joint.

The 2nd pair of legs reach to the base of the fingers of the larger cheliped.

The gills are in all respects typical phyllobranchiæ.

The unique specimen has the carapace 6 millim. long and the abdomen 12 millim., measured in the middle line.

Arabian Sea, off the Travancore coast, 430 fathoms.

Regd. No.  $\frac{2133}{10}$  (Type of the species).

#### STENOPIDEA, Spence Bate.

Spence Bate, *Challenger Crust. Macrura*, p. 206: Stebbing, *Hist. Crust.*, p. 211: Ortmann, in Bronn's *Thier-Reich, Malacostraca*, p. 1134.

The pleura of the 1st abdominal somite are not overlapped by those of the 2nd.

The incisor portion of the mandible is separated from the molar portion by a groove: the endopodite (palp) of the mandible is not foliaceous.

The coxopodite of the 2nd maxillæ is cleft into two lobes, which though of unequal size are equally prominent towards the middle line of the body.

The endopodite of the 1st maxillipeds is short and articulated.

The last joint of the 2nd maxillipeds is a distinct dactylus, articulating end-on with the distal end of the propodite.

The external maxillipeds are distinctly seven-jointed.

The first three pairs of thoracic legs are chelate, the 3rd pair being the longest and stoutest.

The endopodites of the abdominal appendages have no internal appendix at their base.

The branchiæ are trichobranchiæ.

The ova when laid are attached to the abdominal appendages of the female.

Family *Stenopidæ*, Spence Bate.

Spence Bate, Challenger Crust. Macrura, p. 206: Stebbing, Hist. Crust., p. 211: Ortmann, in Bronn's Thier-Reich, Malacostraca, p. 1134.

Carapace of no great length, body not compressed. Rostrum of no great length, compressed. The pleura of the 2nd abdominal somite do not overlap those of the first.

No distinct antennular scale (stylocerite). Antennal scale well developed.

The mandible has an incurved 3-jointed palp, and its incisor and molar processes are separated merely by a groove.

The coxa and basis of the 1st and 2nd maxillæ and 1st maxillipeds are well developed, the coxa of the 2nd maxillæ not receding and being deeply cleft transversely into two (unequal) lobes.

The terminal joint of the 2nd maxillipeds is a distinct dactylus articulating end on with the distal end of the propodite.

External maxillipeds long pediform.

The first three pairs of thoracic legs are chelate, the third pair being the longest and stoutest. No exopodites on any of the thoracic legs.

*Key to the genera of Stenopidæ of the Indian Benthos.*

- |     |   |                      |
|-----|---|----------------------|
| I.  | The exopodite of the external maxillipeds is well developed: the carpus of the 3rd pair of thoracic legs is of good length:—    |                      |
|     | 1. Eyes present: dactylus of 4th and 5th thoracic legs simple and of good length  | ... .. ENGYSTENOPUS. |
|     | 2. Eyes obsolete: dactylus of 4th and 5th thoracic legs short and bifid   | ... .. RICHARDINA.   |
| II. | The exopodite of the external maxillipeds is a mere rudiment: the carpus of the 3rd pair of thoracic legs is short and trigonal | ... .. SPONGICOLA.   |

## ENGYSTENOPUS, Alcock and Anderson.

*Engystenopus*, Alcock and Anderson, Journ. Asiatic Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 149.

Body smooth, not compressed. Rostrum short, laterally compressed. Telson dorsally spinose, blunt and rounded off, about as long as the caudal swimmerets, the outer of which has no transverse fissure.

Eyestalks short, eyes small. Antennular peduncle short, with the basal joint dorsally concave: two longish stiffish antennular flagella. Antennal scale large.

Mandible with incurved 3-jointed palp. All three pairs of maxillipeds with well developed flagelliform exopodites.

First 3 pairs of thoracic legs chelate, increasing in length in posterior succession: the first 2 pairs slender; the 3rd pair stouter, but still of slender

make up to the end of the carpus, which is distally expanded to support a very large hand and chelæ.

The 4th and 5th pairs of legs end in a simple falcate dactylus of good length and have the carpus and propodite obscurely divided into a few longish segments.

Abdominal appendages behind the 1st pair, biramous.

The branchial formula is as follows :—

Somites and their Appendages.	Podobranchiæ.	Arthrobranchiæ.		Pleurobranchiæ.	
		Anterior.	Posterior.		
VII	(ep.)	0	0	0	= ep.
VIII	1 (ep.)	0	1	0	= 2+ep.
IX	(ep.)	1	1	1	= 3+ep.
X	(ep.)	1	1	1	= 3+ep.
XI	(ep.)	1	1	1	= 3+ep.
XII	(ep.)	1	1	1	= 3+ep.
XIII	(ep.)	1	1	1	= 3+ep.
XIV	0	0	0	1	= 1
Total	1+7 ep.	5	6	6	= 18+7 ep.

*Engystenopus* only differs from *Stenopus* in having the carapace practically non-spinous and the dactyli of the last two pairs of thoracic legs falcate and of good length: the large chelipeds of the 3rd pair also differ considerably in shape.

The original definition of the genus erred in stating that the carpus and propodite of the last 2 pairs of thoracic legs are simple: they are obscurely segmented, not, as in *Stenopus*, being multiarticulate, but being divided into a few long segments.

86. *Engystenopus palmipes*, Alcock and Anderson. Pl. II. fig. 3.

*Engystenopus palmipes*, Alcock and Anderson, Journ. Asiatic Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 149, pl. ix fig. 1.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR. CRUSTACEA, PLATE XXVI. FIG. 3, AND PLATE L. FIG. 5.

Entire surface, except for a few definitely situated spines, chiefly on certain of the appendages, perfectly smooth and polished.

The carapace, measured in the middle line without the rostrum, is about half the length of the abdomen: its frontal border on either side of the rostrum is, like the posterior border, strongly emarginate, and is armed at each antero-lateral angle with a pair of small spinelets: its regions, with the exception of the gastric, are ill-defined. The rostrum, which reaches to about the middle of the second joint of the antennular peduncle, has a slight double curve: its concave upper border bears numerous very close sharp equal serrations, and its convex lower border has a single spine large enough to make the rostrum, when



viewed from the side, appear unequally bifid: on the front part of the well-defined gastric region, on either side of the base of the rostrum, is a procumbent acicular spine. Of the abdominal terga the third is of predominant size. The angular abdominal pleura have the edge distantly and unevenly spinulate. The telson is similar in shape and sub-equal in size to the lobes of the swimmeret. The eye-stalks are very short—about half the length of the free portion of the rostrum: the eyes are small, opaque, and deficient in pigment.

The antennular peduncles are between one-third and one-half the length of the carapace: the sub-equal antennular flagella are more than half as long again as the entire animal. The basal joint of the antennæ is spiny at the antero-external angle, as is also the outer border of the broadly falcate antennal scale, this last being more than half the length of the carapace and being fringed with setæ of great length along its inner border. The mandibular palps are incurved and 3-jointed. The external maxillipeds are pediform, and are hairy along the inner edge: their segments are all simple and undivided, and their tips reach to the end of the antennal scale.

The thoracic legs are bilaterally symmetrical: the first three pairs are chelate and have the carpus long, the first two pairs being very slender, and the third pair also being slender as far as the hands, which are enormously expanded. Those of the first pair are not much longer than the external maxillipeds, those of the second pair exceed by about one-third of their length those of the first, while those of the third pair are longer by the extent of the dactylus than the entire animal. In this pair the basis ischium and carpus are long and slender, and the two last-named joints have both the inner and the outer border distantly and sharply spinate, the carpus which is as long as the merus, becoming suddenly inflated at its distal end for the support of the huge hands: these hands are symmetrical, but are not quite similar in every detail, the fingers of the one being more closely apposable than those of the other. To describe them more in detail—they form a good deal more than one-third of the entire extent of the third pair of legs, and their greatest breadth, across the palm, is rather more than the greatest breadth of the abdomen: the palms are compressed, with the edges almost carinate and distally finely spinate: the fingers, which are considerably longer than the palm and are also thin and compressed, have their outside edges serrated in the proximal half, and the apposed edges smooth, except for one or two coarse teeth, or tubercles, at the base: in one pair a large tubercle on the propodite fits in between two large tubercles on the opposite finger, while in the other pair—the pair in which the fingers can be completely apposed—there is but one small tubercle on each finger. The fourth and fifth pairs of thoracic legs are slender, are about equal in length to the third pair *minus* the hand, and end each in a simple claw-like dactylus: in both pairs the carpus and propodite are obscurely subdivided, each into about 4 segments.

The abominal appendages exhibit nothing unusual. The caudal swimmeret is somewhat of the Astacidean type, the blades being sub-equal, and being very similar in size and shape to the telson: the outer edge of the exopodite is strongly and sharply serrated.

A single female, about 31 millim. long from tip of rostrum to tip of telson, from the Bay of Bengal, off Trincomallee, 200-350 fms.

The colours in life were: body salmon-red, flecked slightly with white; third pair of trunk legs with white nodes and salmon-pink internodes.

Regd. No.  $\frac{9217}{9}$  (Type of the species).

#### RICHARDINA, A. M. Edw.

*Richardina*, A. Milne Edwards, Rapport Comm. faune sous-marine, p. 41 (Paris, 1882), and Recueil de Fig. de Crust. nouv. plate 8 (Paris, 1883).

Body smooth except for some rows of spines in the anterior part of the carapace, not compressed. Rostrum of moderate length, laterally compressed. Telson blunt-pointed, dorsally spinose, about as long as the caudal swimmerets, the outer of which has no transverse fissure.

Eyestalks present, short, eyes obsolete. Antennular peduncle short and slender: two antennular flagella of unequal length. Antennal scale elongate, broadly falcate.

Mandible with incurved 3-jointed palp. All three pairs of maxillipeds with well formed flagelliform exopodites, those of the 3rd pair comparatively shorter than the others.

The first three pairs of legs are chelate, and increase in length in posterior succession, the 3rd pair are the strongest. The 4th and 5th pairs end either in a simple or bifid dactylus and have the carpus and propodite compounded each of several segments.

Eggs very large.

The branchial formula is exactly the same as that of *Engystenopus*, consisting of 18 branchiæ and 7 epipodites on either side, arranged in the same way.

*Richardina* differs from *Stenopus* chiefly in having the eyes aborted: the body is stouter and more compact and the spines of the carapace are confined to its anterior portion.

#### 87. *Richardina spongicola*, Alcock and Anderson.

*Richardina spongicola*, Alcock and Anderson, Ann. Mag. Nat. Hist., April 1899, p. 291.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLII. FIG. 4.

The carapace, which is of thinner texture than the other parts, is short, broad, and tumid; the prominent posterior edge of the cervical groove is armed

with a row of procumbent spines, and a second concentric but shorter row of spines surrounds the base of the rostrum; otherwise the carapace is smooth.

The rostrum, which is nearly a third the length of the rest of the carapace, has the dorsal edge serrated throughout and the ventral edge serrated in the distal third only.

The eyes, which are on short stoutish stalks, are quite without pigment and have some spinules round their base dorsally: they are not differentiated from the eyestalk.

The antennal scale is falciform; its outer edge ends in a spine, its inner convex edge is strongly ciliated.

The external maxillipeds are stout, a little longer than the 1st pair of legs, and nearly as long as the combined carapace and rostrum; their ischium and merus are compressed and somewhat broadened.

Except for a few spinules on the carpus of the great cheliped the legs are smooth.

The first three pair of legs are truly chelate and the last two pair are apparently so, since their small dactylus is bifid.

The first pair is slender. The second pair is also slender, but is much longer than the 1st pair. The third pair is of more than Alphean oddness, the left being slender and non-elongate, while the right is nearly as long as the body without the telson and is very massive, especially as regards the hand, which is not compressed and is twice as long as broad. The last two pair have a three-joint carpus and a two-joint propodite.

The abdomen is perfectly smooth except for the telson, which is longitudinally divided into two lobes by a deep groove, the strong convexity of each groove being spiny.

The first pair of abdominal legs in the female are uniramous, the last pair (swimmeret) have the outer edge of the outer lobe serrated.

The largest specimen, which is an egg-laden female, measures 26 millim. from the tip of the rostrum to the tip of the telson.

The eggs are few and are of very large size—nearly 1.5 millim. in diameter after contraction in spirit.

Taken from a specimen of *Hyalonema masoni* dredged in the Andaman Sea at 498 fathoms. Another small specimen was dredged off the Travancore coast in 430 fathoms.

Regd. No.  $\frac{2360}{10}$  (Type of the species):  $\frac{2395}{10}$ .

## SPONGICOLA, DeHaan.

*Spongicola*, DeHaan, Faun. Japon., Crust., p. 189: Spence Bate, Challenger Crust. Macrura, p. 213.

Body smooth, not compressed. Rostrum short, laterally compressed. Telson dorsally-spinose, bluntly rounded off, about as long as the caudal swimmerets, the outer of which has no transverse fissure.

Eyestalks short, eyes well developed. Antennal peduncle short, supporting two flagella of moderate length, the basal joint not concave dorsally. Antennal scale of good size.

Mandible with incurved 3-jointed palp. The 1st and 2nd maxillipeds have well developed exopodites, but the exopodite of the external maxillipeds is a mere rudiment.

First 3 pairs of legs chelate, increasing in length in posterior succession: the 1st pair slender and equal; the 2nd pair stouter, equal or unequal; the 3rd pair much the stoutest, equal or unequal, with a short trigonal carpus and a large broad hand.

The 4th and 5th pair of legs end in a very short bidentate or tridentate dactylus, and have all their joints simple.

The abdominal appendages behind the 1st are biramous.

Eggs of good size.

My material does not permit me to speak as to the branchial formula, but it is stated by Spence Bate to be as follows:—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.	Pleurobranchiæ.
VIII	1 (ep.)	2	0
IX	(ep.)	2	1
X	(ep.)	2	1
XI	(ep.)	2	1
XII	(ep.)	2	1
XIII	(ep.)	2	1
XIV	0	0	1

88. *Spongicola andamanica*, n. sp. Plate II. fig. 2.

Some of the points in which this small species differs conspicuously from *S. venusta* are italicized.

Rostrum dorsally serrated, reaching a little beyond the eye. A tiny orbital spinule and a small spinule beside the base of the rostrum are present on either side, as well as a row of small spinules running behind and parallel with the antennal portion of the anterior border of the carapace.

Telson with two longitudinal rows of spines dorsally; as long as the caudal swimmerets, of which the outer edge is serrated.



Eyes well pigmented; a few tiny spinules fringe the corneal margin dorsally.

Antennal scale broadly falcate, with the outer edge serrated.

External maxillipeds stoutish, setose.

1st pair of thoracic legs not longer or stouter than the 4th pair, not setose.

2nd pair, equal in the female, *not setose, not half as long again as the 1st pair, fairly slender up to the hand, which is compressed, moderately enlarged, and has the upper border cristiform.*

3rd pair *hardly setose, unequal* (in the female), *much longer* and stouter than the 2nd pair, especially as regards the hand, which is compressed and of great breadth, has the fingers about half as long as the palm, and in the larger one forms half the total length of the leg. There is a spine near the far end of the upper border of the ischium, and two spines on the lower border of the merus: both the distal angles of the triangular carpus are sharply pronounced, and *both* borders of the palm are serrated, the upper the more strongly: the fingers are falcate, with a few large interlocking teeth.

The 4th and 5th pairs of legs end each in a very short bifid dactylus and have the posterior border of the propodite finely serrated: *the 5th pair is a good deal longer than the 4th.*

The total length of an egg-laden female is 12 millim.

Andaman Sea, 170 and 238 to 290 fathoms. These were dredged in the earlier days of the Survey and I can find no record of the circumstances in which they were taken. The other two species of Spongiicola, namely, *S. venusta* and *S. Koehleri* are commensals of Hexactinellid Sponges.

Regd. Nos.  $\frac{25}{7}$  (Types of the species):  $\frac{9933}{6}$ .

### MACRURA ASTACIDES.

*Décapodes Macroures* (exc. *Salicoques* at *Galathéides*) Milne Edwards, Hist. Nat. Crust. II. 265.

*Macrura Astacina* (exc. *Megalopidea*) De Haan, Faun. Japon., Crust., p. 142.

*Thalassinidea* et *Astacidea*, Dana, U. S. Expl. Exp. pt. I Crust., pp. 500, 501.

*Reptantia* (exc. *Anomala* et *Brachyura*) Boas, Vid. Selsk. Skr., 6 Raekke, naturvid. o. mathemat. Afd. I. 2, p. 156: Ortmann, in Bronn's Thier Reich (*Malacostraea*), pp. 1116 et seq.

*Trichobranchiata Normalia* (exc. *Stenopidea*) et *Aberrantia* (exc. *Galathéide* et *Pylochelidæ*), Spence Bate, Challenger Macrura, pp. 7, 199.

*Thalassinidea, Scyllaridea* et *Astacidea*, Stebbing, Hist. Crust., pp. 180, 191, 199.

Body not compressed, sometimes depressed; rostrum, when present, not compressed, usually depressed: integument usually strongly calcified. Abdomen long, not flexed or humped, symmetrical: the pleura of the 1st abdominal somite much reduced. Telson generally quadrangular, occasionally acute.

The basal joint of the antennular peduncle has no "scale" on its outer margin: the olfactory setæ are in the distal part of the outer antennular flagellum.

The antennal scale, when present, is of small or medium size, and never wholly conceals the antennal peduncle.

The external maxillipeds are almost always pediform and are always much shorter than the 1st pair of thoracic legs.

All five pairs of thoracic legs are almost always strongly developed: a variable number of them—sometimes all, sometimes the 1st alone, or the first 2, or the first 3, sometimes the last alone, sometimes none at all—are chelate, and the 1st pair are usually much longer and stouter than any of the others.

The appendages of the 1st abdominal somite, when present, are uniramous and are often modified in the male for copulation.

The genital openings of the male are pierced in the coxopodites of the 5th pair of thoracic legs.

The *Astacides* may be divided into two groups, namely

(1) The *Astacidea* proper, in which all the segments of the thoracic sternum are usually but not always firmly united, and in which the abdominal terga overlap one another, and

(2) the *Thalassinidea*, in which the last segment of the thoracic sternum is independent, and the abdominal terga do not overlap one another or overlap very slightly.

#### *Synopsis of the families of Macrura Astacides of the Indian Benthos.*

I. All the thoracic sterna are firmly united together: the abdominal terga overlap one another, and the abdominal pleura behind the 1st are well developed:—

1. Carapace subcylindrical, ending in a long strong rostrum; its anterolateral inflexions are not fused with the epistome, and its postero-lateral angles, though they lie beneath the projecting angles of the 1st abdominal tergum, are not firmly held by any pegs or processes. In the 2nd maxillæ and 1st maxillipeds the manducant functions are not less important than the respiratory. Thoracic sternum narrow. [The antennal peduncle consists of five movable joints, and the flagellum is a long lash. All the maxillipeds have flagelliform exopodites. The first 3 pairs of thoracic legs are chelate and the 1st pair much enlarged. The telson is quadrangular or truncated. The 1st abdominal somite has a pair of uniramous appendages]. *Nephropsidea* ... ..

**NEPHROPSIDEÆ.**

2. Carapace either subcylindrical (rarely globose) or depressed; antero-laterally it is fused with the epistome, and its postero-lateral angles are firmly held by special pegs or processes of the 1st abdominal somite: the rostrum is either absent or represented by a mere spine. In the 2nd maxillæ and 1st

maxillipeds the manducant functions are more or less subordinate to the respiratory:—

- i. Sternum not broad: carapace either depressed or globose. The antennal peduncle consists of five movable joints, and an antennal scale is present. The 2nd and 3rd maxillipeds have no exopodites. At least the first 4 pairs of thoracic legs are chelate, the 1st pair being much larger and longer than the others. The telson is acute. The 1st abdominal somite has a pair of uniramous appendages. [*Eryoni-dea*] ... .. ERYONIDÆ.
  - ii. Sternum broad. The basal joint of the antennal peduncle is merged in the epistome, and no antennal scale is present. All the maxillipeds have exopodites. None of the thoracic legs are particularly enlarged, and none, except sometimes the last pair in the female, are chelate. The telson is subquadrangular and is coriaceous in its posterior half. The 1st abdominal somite is destitute of appendages. [*Loricata*]:—
    - a. Carapace subcylindrical (occasionally cuboidal): the eyes are not enclosed in orbits: the antennal flagellum is a long lash ... PALINURIDÆ.
    - b. Carapace strongly depressed: the eyes are enclosed in orbits: the antennæ are broadly lamellar ... .. SCYLLARIDÆ.
- II. The last segment of the narrow thoracic sternum is movable and independent: the abdominal terga overlap one another hardly or not at all. [The rostrum is small and triangular, or rudimentary. The carapace is not fused with the epistome or in any way overlapped by the 1st abdominal tergum. The antennal peduncle consists of five movable joints and supports a lash-like flagellum. The telson is usually subquadrangular, and the 1st abdominal somite usually carries a pair of uniramous appendages. *Thalassinidea*]:—
1. The abdominal pleura behind the 1st are well developed. The antennular flagella are much longer than their peduncle: a spiniform antennal scale is often present: the maxillipeds and the first 4 pairs of thoracic legs have foliaceous epipodites ... .. AXIIDÆ.
  2. The abdominal pleura are rudimentary or absent. The antennular flagella are little or not at all longer than their peduncle. No antennal scale. No epipodites behind the 1st maxillipeds ... .. CALLIANASSIDÆ.

### Family *Nephropsida*, Stebbing.

Stebbing, Hist. Crust., p. 201: Ortmann, in Bronn's Thier Reich, Malacostraca, p. 1139.  
*Homaridæ*, Spence Bate, Challenger Crust. Macrura, p. 170.

Cephalothorax subcylindrical, the carapace produced anteriorly to a stout rostrum, and overlapping the 1st abdominal somite posteriorly. The abdominal

terga overlap one another: the abdominal pleura behind the first are well developed, but the first is almost obsolete: the telson is broadly truncated.

Two antennular flagella of moderate length, much longer than the peduncle. The antennal scale is usually present, but may be absent: the antennal peduncle is five-jointed, and the flagellum lash-like.

Mandible with the incisor portion separated from the molar by a groove, the incisor portion much the larger and more prominent: mandibular palp incurved, three-jointed.

Palp of the 1st maxilla bi-articulate: coxa and basis of 1st and 2nd maxilla and of 1st maxilliped almost equally well developed, the coxa of the 2nd maxilla deeply cleft transversely, the exopodite of the 1st maxillipeds not stouter than the endopodite.

All the maxillipeds have well developed flagellate exopodites and large epipodites, the external maxillipeds are stout, pediform, and 7-jointed, but are much shorter than any of the thoracic legs.

The thoracic legs are all 7-jointed, but in the 1st pair there is no independent motion at all between the 2nd and 3rd joints (basis and ischium). The first three pairs are chelate, the 1st pair being much the longest and most massive: the last two pairs are monodaetylous. Large foliaceous epipodites are present on the first four pairs, these being completely independent of the podobranchiæ.

The abdominal appendages behind the 1st pair are biramous. Those of the 1st pair are uniramous, weak and slender in the female, but stout and rigid in the male, in which sex they are channelled along the inner surface so as to form by their apposition a tubular organ of copulation. In the male also the endopodite of the 2nd pair of appendages bears, on its inner edge, a rigid appendix that can be ensheathed within the tube formed by the apposition of the 1st pair.

*Synopsis of the genera of Nephropsidæ of the Indian Benthos.*

I. A foliaceous antennal scale is present:—

1. Eyes very large and well-pigmented: third joint of the antennular peduncle shorter than the 2nd: 2nd pair of legs a little stouter than the 3rd     ...     ...     ...     ...     ...     NEPHROPS.
2. Eyes obsolescent, not pigmented and not differentiated from the eyestalks: 3rd joint of the antennular peduncle as long as or longer than the 2nd: 2nd pair of legs slenderer and much longer than the 3rd     ...     ...     ...     ...     ...     PHOBERUS.

- II. No antennal scale: eyes obsolescent, without pigment and not properly differentiated from the eyestalks: 3rd joint of the antennular peduncle much longer than the second: 2nd pair of legs decidedly stouter than the 3rd     ...     ...     ...     ...     ...     ...     NEPHROPSIS.



## NEPHROPS, Leach.

*Nephrops*. Leach, Malac. Pod. Brit. text preceding pl. xxxvi: Milne Edwards, Hist. Nat. Crust. II. 335: Spence Bate, Challenger Crust. Macrura, p. 184.

Rostrum of good length, depressed at least in its proximal half, armed with teeth. Carapace (without rostrum) more than half the length of the abdomen, divided into two portions by a very broad and deep cervical groove, usually sculptured with longitudinal ridges. Telson almost square, about as long as the caudal swimmerets, the outer of which is transversely fissured.

Eyes very large, reniform, deeply pigmented. The basal joint of the antennular peduncle is as long as the 2nd and 3rd joints combined, and has no "stylocerite": the antennular flagella are shorter than the carapace proper, the outer being slightly shorter and stouter than the inner. Antennal scale foliaceous, of moderate length, not concealing the terminal joint of the antennal peduncle.

1st pair of thoracic legs chelate, longer and vastly stouter than any of the others, but little unequal in the male, their joints prismatic. 2nd-5th legs sub-cylindrical, comparatively slender, the 2nd and 3rd chelate.

The abdominal appendages from the 2nd to the 5th have short foliaceous rami. The modified 1st pair of the male are pointed and scoop-shaped, the anterior lip of the scoop having at its far end a roughened facet for making fast when these appendages are apposed. The male appendix of the endopodite of the 2nd pair of appendages is short, spatulate and ecurvate.

The branchial formula is as follows:—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.	Pleurobranchiæ.	
VII	(ep.)	0	0	= ep.
VIII	1 (ep.)	0	0	= 1+ep.
IX	1 (ep.)	2	0	= 3+ep.
X	1 (ep.)	2	0	= 3+ep.
XI	1 (ep.)	2	1	= 4+ep.
XII	1 (ep.)	2	1	= 4+ep.
XIII	1 (ep.)	2	1	= 4+ep.
XIV	0	0	1	= 1
Total	6+7 ep.	10	4	= 20+7 ep.

The podobranch of the 2nd maxillipeds is small but well plumed.

89. *Nephrops thomsoni*, Spence Bate.

*Nephrops thomsoni*, Spence Bate, Challenger Crust. Macrura, p. 185, pl. xxv, xxvi: Ortmann, Zool. Jahrb., Syst. &c., X. 1897-98, p. 273.

*Nephrops thomsoni* var. *andamanica*, Wood-Mason.

*Nephrops andamanica* Wood-Mason, Alcock, Ann. Mag. Nat. Hist., March 1894, p. 226: Ortmann, *loc. cit.*

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA PLATE IV. FIG. I AND VIII. FIG. 5.

The rostrum, which reaches beyond the antennal peduncles and is about

half the length of the rest of the carapace, is broad depressed and slightly declivous in its basal half, and upcurved and strongly compressed in its distal half: it is armed on either margin, near the middle, with a large tooth, and beyond this, ventrally, with a single curved spine: its margins are continued backwards, nearly as far as the broad deep cervical groove, as a pair of strong outstanding carinæ, each of which is cut into *three* teeth—the first tooth being much the largest: between these two carinæ is a low median ridge.

The post-antennal spine is trenchant, wing-like, and of great size, its base reaching nearly to the hepatic groove, its tip reaching beyond the base of the antennal scale: behind and below it is a hepatic spine, while between it and the great postrostral crest are 4 spines—one postorbital, and three in an oblique series higher up.

Behind the cervical groove the carapace is longitudinally traversed by 7 ridges—a median, which is really double, and 3 on either side—not including a marginal ridge: the median ridge is coarsely granular or dentate and ends anteriorly in a pair of spines, the 3 lateral ridges end anteriorly each in a little spine. The general surface of the carapace is finely tomentose.

The abdominal terga from the 2nd to the 5th are smoothly sculptured on one plan: their broad smooth lateral and posterior borders are raised, and they are traversed fore and aft by a low broad median ridge, and the area on either side of the ridge is symmetrically eroded. The 6th tergum is armed with 3 spines—one in either lateral area and one in the middle of the posterior border—not including the spine in which each of its pleura ends.

The square telson has a spine at either posterior angle and a pair of median spines near its anterior end: the outer angles of the caudal swimmerets are acutely produced, and the greater part of the edge of the transverse suture of the outer swimmeret is serrated.

The abdominal pleura from the 2nd to the 5th are recurved and acute. The 1st abdominal sternum has a strong (epimeral) tooth or spine outside the articulation of either of its appendages: in the male, the sterna from the 2nd to the 5th have a small median spine.

The eyes are very large, and the proximal end of the basal joint of the antennular peduncle forms, dorsally, a smooth plate, upon which the eye partly rests. The antennal scale is almost hemispherical, with the convexity inwards, its length is about a fifth that of the carapace.

The external maxillipeds reach a little beyond the antennal peduncle: their ventral border is setose and the inner border of their ischium is furnished with an elegant set of teeth.

The 1st pair of legs in the adult male are almost as long as the entire body, more than half their length being contributed by the hand: the ischium is

somewhat compressed, though trigonal, and its 3 edges are serrated up to a strong terminal tooth or lobe: the carpus is granular in places, the granules being dentiform and having a linear tendency; distally the angles of the carpus are produced to spines, and there is also a large spine at the near end of the outer border: in the male nearly half, and in the female a little more than half, of the hand is formed by the fingers, which are slender and hooked at tip: the palm, though prismatic, is compressed and is fluted, with serrated ridges: the fingers are finely toothed, the teeth though of several sizes having an uniform appearance and being a good deal embedded in fur; one tooth near the basal end of the fixed finger is conspicuously prominent.

The other legs are smooth and slender; the 5th pair are the shortest, and the 4th pair—which are as long as the carapace and rostrum and first two abdominal somites combined—are the longest.

The dimensions of the largest male and largest egg-laden female in the collection are as follows:—

	Length of rostrum.	Length of carapace.	Length of abdomen.
Male.	28 millim.	54 millim.	92 millim.
Female.	24 „	49 „	79 „

The colours in life were: dorsum yellowish pink; venter pink in the female, white in the male: chelipeds banded pink and yellow in the female, pink and white in the male. Eggs dark blue.

Andaman Sea, 185, 188–220, 265, 271 and 405 fathoms.

The embryo, extracted from the egg, has a globular cephalothorax and a long segmented abdomen ending in a great fan. All the appendages are present including those of the abdomen, which have the same form as those of the adult: the caudal swimmerets are covered by the great terminal fan.

Regd. Nos.  $\frac{8557}{6}$  :  $\frac{3112}{9}$  :  $\frac{6852-6860}{9}$  :  $\frac{1386-1388}{10}$  :  $\frac{2176}{10}$ .

#### PHOBERUS, A. Milne Edwards.

*Phoberus*, A. Milne Edwards, Ann. Sci. Nat., Zool., (6) XI. 1881, Art. 4, p. 1: Spence Bate, Challenger Crust. Macrura, p. 170.

Rostrum of good length, broad and depressed at base, armed with teeth. Carapace (without rostrum) more than half the length of the abdomen, the cervical groove conspicuous. Telson subquadrate but somewhat elongate, as long as the caudal swimmerets, the exopodite of which is transversely fissured.

Eyes obsolescent, without pigment and not differentiated from the eye-stalks which are placed close together beneath the base of the rostrum. The 3rd joint of the antennular peduncle is as long as or longer than the 2nd: the antennular flagella, of which the outer is the shorter, are not as long as the carapace proper.

Antennal scale long, foliaceous, not concealing the terminal joint of the antennal peduncle.

The 1st pair of thoracic legs though the longest and much the stoutest, are still of a *comparatively* slender cast: they end in long slender chelæ, having sub-cylindrical palms and long compressed fingers. The 2nd and 3rd pairs are chelate, the 2nd pair being slenderer and much longer than the 3rd.

The 1st pair of abdominal appendages are uniramous, slender in the female, modified in the male to a pair of longish subacute lamellæ channelled along the inner surface. The 2nd–5th pairs are weak and biramous, the rami being narrow and of no great length: in the male the endopodite of the 2nd pair has a rigid internal appendix of good length.

The branchial formula is as follows:—

Somites and their Appendages.	Podobranchiæ.	Arthrobranchiæ.	Pleurobranchiæ.	
VII	(ep.)	0	0	= ep.
VIII	1 (ep.)	0	0	= 1 + ep.
IX	1 (ep.)	2	0	= 3 + ep.
X	1 (ep.)	2	0	= 3 + ep.
XI	1 (ep.)	2	1	= 4 + ep.
XII	1 (ep.)	2	1	= 4 + ep.
XIII	1 (ep.)	2	1	= 4 + ep.
XIV	0	0	1	= 1
Total	6 + 7 ep.	10	4	= 20 + 7 ep.

The podobranch of the 2nd maxillipeds is small but plumose.

### 90. *Phoberus cæcus*, A. M. Edw.

*Phoberus cæcus*, A. Milne Edwards, Ann. Sci. Nat., Zool., (6) XI. 1881, Art. 4, p. 1, and Recueil de Fig. de Crust. nouv. pl. 36: A. Agassiz, Bull. Mus. Comp. Zool. XV. 1888, p. 44, fig. 241.

#### *Phoberus cæcus* var. *tenuimanus*, Spence Bate.

*Phoberus tenuimanus*, Spence Bate, Challenger Crust. Macrura, p. 171, pls. xxi, xxii.  
*Phoberus cæcus* var. *sublevis*; Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 197.

Appears to differ from *P. cæcus* typicus in having the fingers of the large chelipeds longer.

Carapace, legs, tail-fan, abdominal pleura and the greater part of all the abdominal terga covered, in the adult, with prickles and sharp granules. [In the young the integument is much less prickly and on the abdominal terga is almost smooth].

Rostrum more than half the length of the rest of the carapace, upcurved, broad depressed and dorsally concave at base, but soon becoming acutely sub-styliform: its styliform portion is serrated ventrally, and is either smooth or



bears from one to three teeth dorsally: the margins of its broad basal portion are armed each with one spine, and are continued backwards to the hinder part of the gastric region each as a bold serrated carina.

In the middle line the carapace is traversed throughout its extent by a spinose carina. The cervical groove is conspicuous. The post-antennal spine is of good size, and there are several small spines in a line behind it.

The 3rd joint of the antennular peduncle is longer than the 2nd, but shorter than the 1st. The antennal scale is about two-fifths the length of the carapace proper, measured in the middle line; its outer border is thickened and ends acutely, and its dorsal surface in the adult is spinulose. In the antennal peduncle the outer border of the 2nd joint, the ventral border of the 3rd joint, and the inner border of the remarkably elongate 4th joint end each in a spine.

The large chelipeds in the male are as long as the body from the tip of the rostrum to the end of the telson, more than half their length being contributed by the hand, while of the hand itself nearer two-thirds than half is formed by the fingers: in addition to the prickles that cover their surface, there is a row of spines along the ventral border of the merus and another along the dorsal border of the dactylus, as well as some enlarged spines at the distal end of merus and carpus, and one on either side of the broadened base of the dactylus: the much compressed fingers are furnished with teeth of about 5 different sizes, elegantly arranged in alternating systems.

The 2nd pair of legs, which reach just beyond the base of the fingers of the 1st pair, are much longer and distinctly slenderer than any of the other three pairs.

Colour in life, delicate pink.

In the largest specimen of our collection the length of the rostrum is 42.5 millim., of the carapace 77 millim., of the abdomen 139 millim.

From the Arabian Sea, 550, 636, 740, and 912-931 fathoms.

Regd. Nos.  $\frac{5989}{9} : \frac{9306}{9} : \frac{45}{10} : \frac{1385}{10}$ .

#### NEPHROPSIS, Wood-Mason.

*Nephropsis*, Wood-Mason, Journ. Asiatic Soc. Bengal, Vol. XLII. pt. 2, 1873, p. 39, and Ann. Mag. Nat. Hist., (4) XII. 1873, p. 59; Spence Bate, Challenger Crust. Macrura, p. 175.

Rostrum of good length, stout, with or without lateral spines. Carapace (without rostrum) more than half the length of the abdomen, the cervical groove very well defined. Telson quadrate but somewhat elongate, about as long as the caudal swimmerets, the outer of which usually (but not in every species) has a transverse suture.

Eyes very small, without pigment, hardly differentiated from the eyestalks, which lie close together beneath the rostrum.

The 3rd joint of the antennular peduncle is as long as or longer than the 1st, which has no stylocerite: the antennular flagella are shorter than the carapace proper, the outer being decidedly the stouter.

No antennal scale.

1st pair of legs chelate, much the longest and stoutest, a little unequal in the male; though the joints are massive they are not cumbrous: 2nd pair somewhat compressed and a little stouter than those behind them, which are slender and subcylindrical: the 2nd and 3rd pairs chelate.

The rami of the abdominal appendages from the 2nd to the 5th are long slender and setose. The modified 1st pair in the male are slender pointed lamellæ, channelled along the inner surface. The male appendix of the endopodite of the 2nd pair is a long slender rod fringed distally with stiff setæ.

The branchial formula is as follows:—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.	Pleurobranchiæ.		
VII	(ep.)	0	0	=	ep.
VIII	(ep.)	0	0	=	ep.
IX	1 (ep.)	2	0	=	3+ep.
X	1 (ep.)	2	0	=	3+ep.
XI	1 (ep.)	2	1	=	4+ep.
XII	1 (ep.)	2	1	=	4+ep.
XIII	1 (ep.)	2	1	=	4+ep.
XIV	0	0	1	=	1
Total	5+7 ep.	10	4	=	19+7ep.

### Key to the Indian species of *Nephropsis*.

#### I. The exopodite of the tail-fan is transversely fissured:—

##### 1. Rostrum with lateral spines: no distinct spines behind the cervical groove:—

##### i. No distinct spine on the anterior border of the 2nd abdominal pleura: rostrum with only one pair of lateral spines:—

a. Abdominal terga without any trace of a median carina ... .. *N. Stewartii*.

b. The abdominal terga, from the 3rd to the 6th, are faintly carinated in the middle line ... .. *N. Carpenteri*.

##### ii. A spine near the middle of the anterior border of the 2nd abdominal pleura ... .. *N. atlantica*.

##### 2. Rostrum without any lateral spines: a pair of small spines overhang the cervical groove from behind, in the middle line ... .. *N. ensirostris*.

#### II. The exopodite of the tail-fan is not fissured: rostrum with lateral spines: at least one spine on the anterior edge of the 2nd, 3rd and 4th abdominal pleura ... .. *N. Suhmi*.

91. *Nephropsis Stewarti*, Wood-Mason.

*Nephropsis Stewarti*, Wood-Mason, Journ. Asiatic Soc. Bengal, Vol. XLII, pt. 2, 1873, p. 40, pl. iv. and Ann. Mag. Nat. Hist. (4) XII, 1873, p. 59: A. Milne Edwards, Ann. Sci. Nat., Zool. (5) XIX, 1874, 7, pl. 20, figs. 1-3. Norman, Ann. Mag. Nat. Hist. (5) IV, 1879, p. 182.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XXVII. FIG. 1.

The whole of the body, sterna excepted, is covered with a close short fur, beneath which are numerous discrete miliary tubercles.

The rostrum is from two-fifths to a little more than a half the length of the rest of the carapace, measured in the middle line: it is doubly curved, and has a single pair of lateral teeth situated near the middle, and a single pair of spines—similar to and almost in the same transverse line with the antennal spines—at its base: it is finely grooved in the mid-dorsal line up to a small gastric tubercle, behind which the groove is very very faintly continued up to a small tubercle situated near the posterior border of the carapace.

The grooves of the carapace are very conspicuous, especially the cervical groove, which is broadly U-shaped and is continued with uninterrupted emphasis right across the mid-dorsal line. The branchial area is well defined by a broad ridge, on either side.

The abdominal terga are delimited from the pleura by curved ridges: they have no trace of median carination. Telson traversed by two diverging ridges which end each in a strong spine; the outer borders of the caudal swimmerets are also acutely produced posteriorly, and the exopodite is transversely fissured. The abdominal pleura 2-5 are recurved and acute but not spine-like: the 6th pleuron has its posterior angle produced to a spine.

The 3rd joint of the antennular peduncle is nearly as long as the 1st and 2nd combined: the 1st joint is dorsally inflated.

The external maxillipeds reach the end of the antennular peduncle, their ventral border is setose, and the inner edge of their ischium is provided with an elegant set of teeth.

The larger chelipeds are covered with a shaggy tomentum, beneath which are numerous miliary tubercles: they are not quite equal in the male, where the larger one is about as long as the body behind the middle of the gastric region, the hand being as long as the first four joints: there are 2 or 3 spinules at the end of the merus and carpus and 1 or 2 on the inner surface of the carpus: the fingers, which are about as long as the palm, end in strongly calcified naked hooked tips, and their cutting edges are finely and evenly crenulate. In the female the large chelipeds are not much longer than the abdomen, and the hand is hardly as long as the combined ischium and merus.

The 2nd pair of legs, which are slightly stouter than those behind them, may be a little unequal in the adult male.

In the male the coxæ of the 2nd-4th pairs of legs have the inner surface concave and produced to short vertical teeth or tubercles, one of which—on the 3rd pair—is slightly hooked. In the female between the 4th pair of legs is a pair of elongate compressed sternal tubercles.

The modified 1st pair of abdominal appendages of the male, though movable enough, are always flexed and cannot be extended backwards: they are long narrow pointed laminae, with the inner surface concave and with the anterior border notched near where it comes in contact with the prominent genital tubercle of the coxa of the 5th pair of legs.

In an egg-laden female the length of the rostrum is 16.5 millim., of the carapace 30 millim., of the abdomen 58 millim. In the largest male the length of the rostrum is 18 millim., of the carapace 43 millim., of abdomen 86 millim.

From the Andaman Sea, 188-220, 261 and 405 fathoms; from the Bay of Bengal, 270 fathoms; from the Arabian Sea, 360, 406 and 449-465 fathoms.

Wood-Mason, with whom I agree, considered *N. agassizii* A.M.E. (= *aculeata* S. I. Smith) to be identical with this species.

Regd. Nos. 1404 (Type of the species) :  $\frac{3111}{9}$  :  $\frac{6861-6868}{9}$  :  $\frac{8670}{9}$  :  $\frac{39}{10}$  :  $\frac{1406-1407}{10}$  :  $\frac{2014}{10}$  :  $\frac{3373}{10}$ .

## 92. *Nephropsis Carpenteri*. Wood-Mason.

*Nephropsis Carpenteri*, Wood-Mason, Proc. Asiatic Soc. Bengal. 1885. p. 70: Alcock and Anderson, Journ. Asiatic Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 161.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XXVII. FIG. 2.

Closely resembles *N. Stewarti*, from which it differs only in the following characters:—

The rostrum is never more than two-fifths the length of the rest of the carapace measured in the middle line, and is almost straight.

The cervical groove is broadly V-shaped, and though not actually interrupted, is indistinct in the mid-dorsal line.

The abdominal terga from the 3rd to the 6th are longitudinally traversed, in more or less of their extent, by a low, median, granular carina.

The 3rd joint of the antennular peduncle is only about as long as the 1st joint.

The longer of the large chelipeds of the male is only as long as the body behind the cervical suture, and its hand is hardly as long as its combined ischium and merus.

Colours in life variable. Ivory white with orange-red markings (Giles: *female*). Pink, with white antennules and antennæ, and with the two median tubercles of the back white (Anderson).



In an egg-laden female the length of the rostrum is 11 millim., of the carapace 33.5 millim., of the abdomen 57 millim.

From the Bay of Bengal, 193, 145-250, and 272 fathoms.

The eggs are singularly large.

Regd. Nos.  $\frac{4251}{7}$  (Type of the species) :  $\frac{4252}{7}$  :  $\frac{6282}{9}$  :  $\frac{8672-8679}{9}$  :  $\frac{8682-8687}{9}$  :  $\frac{9835-9837}{9}$ .

### 93. *Nephropsis atlantica*. Norman.

*Nephropsis atlantica*, Norman, Proc. Roy. Soc. Edin. XI. 1881-82, p. 684; Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, pp. 197, 198, fig. : Caullery, Caudan Crust., in Ann. l'Univ. Lyon, 1896, p. 384.

The following characters distinguish this species from *N. Stewartii*, which it otherwise closely resembles.

The carapace and chelipeds are granular, but there are no discrete granules or tubercles beneath the fur that covers the body.

The rostrum is never less than half the length of the rest of the carapace and usually has *two* pairs of lateral spines: sometimes there are three pairs, occasionally  $1\frac{1}{2}$  pair only.

Behind the pair of large spines at the base of the rostrum is a second pair of small spines, and between these two pairs of spines are two rows of spinules diverging from the base of the rostrum and enclosing a median compressed tubercle.

The abdominal terga, from the 2nd to the 6th, are longitudinally traversed, in more or less of their extent, by a low smooth carina.

The abdominal pleura from the 2nd to the 5th are produced vertically each into a needle-like spine; and on the anterior border of the 2nd pleuron, near the middle, is an antorse spinule.

The large chelipeds in the adult male are only as long as the body behind the cervical groove, and the hand is shorter than the combined ischium and merus.

The claw-like tooth of the coxæ of the legs of the 3rd pair is particularly prominent.

The colours in life were pink, with a broad white longitudinal dorsal stripe.

In an egg-laden female the length of the rostrum is 12 millim., of the carapace 22.5 millim., of the abdomen 40 millim.: adult males have the same dimensions.

Arabian Sea near the Laccadives and to the northwards, at 636, 696 and 740 fathoms.

Regd. Nos.  $\frac{6017-6022}{9}$  :  $\frac{8841-8849}{9}$  :  $\frac{9307-9310}{9}$ .

94. *Nephropsis ensirostris*, n. sp. Plate I. fig. 2.

The following characters distinguish this species from *N. Stewarti*, which it otherwise closely resembles:—

The carapace and chelipeds are granular, but there are no discrete tubercles beneath the fur that covers the body.

The rostrum, the length of which is half or more that of the rest of the carapace measured in the middle line, is fluted like a bayonet dorsally and is quite unarmed laterally.

On the carapace at the base of the rostrum are 4 spines in a transverse row, namely, a large one on either side, similar to the post-antennal spine, and a pair of little ones between them: behind this, on the gastric region, is a second transverse row of 4 small spines, and between and behind the middle pair of these is a compressed tubercle. [The middle pair of small spines in both of these transverse rows stand upon a pair of ridges that diverge from the base of the rostrum and again converge towards the conspicuous cervical groove].

On the cardiac region, in the middle line, overhanging the cervical groove, is a pair of small spines, the termini of a pair of faint median longitudinal ridges that start from a small tubercle near the posterior border of the carapace.

The abdominal terga up to the 5th are broadly and faintly grooved transversely; and up to the 6th are discontinuously and very faintly carinated in the middle line, though this is extremely inconspicuous in the case of the first 2 or 3 terga.

The abdominal pleura from the 2nd to the 5th end in long acicular spines as in *N. atlantica*: the edges of the pleura are microscopically crenulate, but there is no spine on any of them.

The transverse suture of the exopodite of the caudal swimmeret is very fine.

The large chelipeds of the adult male are only as long as the body behind the cervical groove, and their hand is hardly as long as their ischium and merus combined.

The claw-like tooth of the coxa of the 3rd pair of thoracic legs is, as in *N. atlantica*, particularly prominent.

In an adult male the length of the rostrum is 9 millim., of the carapace 18 millim., of the abdomen 35 millim.

Arabian Sea, north of the Laccadives 636 fathoms; Bay of Bengal, off Ceylon, 320–296 fathoms; Andaman Sea, 498 fathoms.

In form and size this species is much like *N. atlantica*, from which, however, it is easily distinguished by the absence of lateral spines from the rostrum, by

the two transverse rows of spines on the gastric region, and by the absence of a spinule from the anterior border of the 2nd abdominal pleuron.

Regd. Nos.  $\frac{3892}{10}$  (Type of the species) :  $\frac{749}{10}$  :  $\frac{2358}{10}$ .

### 95. *Nephropsis Suhmi*, Spence Bate.

*Nephropsis Suhmi*, Spence Bate, Challenger Crust. Macrura, p. 181, pl. xxiii. fig. 3, pl. xxiv. fig. 2: Anderson, Journ. Asiatic Soc. Bengal, Vol. LXV. pt. 2, 1896, p. 96.

Body and chelipeds covered with a hairy tomentum: carapace, chelipeds, 6th abdominal tergum and dorsal surface of telson covered with sharp discrete miliary tubercles, which on the chelipeds tend to be spiniform and squamiform and on the 6th abdominal tergum to be squamiform: the other abdominal terga are pitted, but not rough or granular.

Rostrum more than half the length of the rest of the carapace, with two pairs of lateral spines.

On the carapace at the base of the rostrum is a pair of large spines—similar to and in the same transverse line with the post-antennal spines—and behind them a pair of small spines, while diverging from the base of the rostrum are two rows of spinules, enclosing between them a small median tubercle and then converging. Behind the very distinct cervical groove the carapace is faintly carinated in the middle line.

The abdominal pleura are, as usual, very distinctly marked off from their terga: the 1st has its anterior angle produced to a tooth and its posterior angle spiniform; the 2nd–5th are all produced vertically to needle-like spines and have a spine (sometimes also 1 or 2 spinules) on their anterior border; the 6th has, as usual, its posterior angle produced to a spine.

The telson and caudal swimmerets agree with those of *N. Stewarti* except in the important particular that the *exopodite is not transversely fissured*.

The appendages differ from those of *N. Stewarti* only in having a few additional spinules on the merus and carpus of the large chelipeds.

Colours in life variable: blood-red with milk-white eyes (*egomet*): pale orange, with broadish white stripe on abdominal terga and posterior part of carapace, antennal bases colourless, hairs on dactyli of last 4 pairs of thoracic legs crimson, cornea opalescent (*Anderson*).

In the largest male the length of the rostrum is 1.4 millim., of the carapace 26 millim., of the abdomen 4.4 millim.

Arabian Sea, 865–880, 891, 922, 931, 947 fathoms.

As usual, the antennal flagella exceed the length of the whole body and there are 2 arthrobranchiæ on the somite that carries the external maxillipeds.

Regd. Nos.  $\frac{6869}{9}$  :  $\frac{40-44}{10}$  :  $\frac{748}{10}$  :  $\frac{3893}{10}$ .

Family *Eryonidae*, Dana.

Dana, U. S. Expl. Exp. Crust., pt. I. p. 515 : Spence Bate, Challenger Crust. Macrura, p. 100 : Stebbing, Hist. Crust., p. 199 : Ortmann in Bronn's Thier Reich, Malacostraca, p. 1136.

See also Norman, Ann. Mag. Nat. Hist. (5) II. 1878, p. 382, and (5) IV. 1879, p. 173.

Carapace either depressed with very sharply defined lateral borders, or (less commonly) truly globose; without rostrum: anteriorly it is soldered to the epistome on either side, posteriorly its angles are nipped and firmly bolted between two peg-like processes of the 1st abdominal somite, the underlying peg standing on the anterior border of the somite, the overlapping peg falling from the angle of the rudimentary pleuron. The abdomen is of good breadth and the telson is acute: the terga overlap one another and the pleura behind the 1st are well developed.

The eyes are rudimentary and the eyestalks are immovably fixed, in all the recent forms.

The antero-internal angle of the basal joint of the antennular peduncle is produced to form a stiff scale. Of the two antennular flagella the inner resembles that of the antennæ while the outer is very short.

The antennal scale is narrow and does not overlap the antennal peduncle, which is five-jointed: the renal tubercle of the basal joint of the peduncle is remarkably prominent: the antennal flagellum is lash-like.

The mandible consists of a convex serrated incisor plate and a three-jointed palp.

The 1st and 2nd maxillæ and the 1st maxillipeds are somewhat remote from the middle line, and appear to take little part in manducation. The 1st maxillæ consist of slender curved coxopodite and basipodite, without palp. The 2nd maxillæ consist of a small coxopodite and basipodite, neither of which is subdivided, a slender endopodite, and a very large scaphognathite. The 1st maxillipeds have a rudimentary coxopodite, an insignificant basipodite, and a slender endopodite; but their exopodite is a huge somewhat convoluted leaf, to the distal end of the inner border of which a reflexed lobe is articulated, the whole organ forming a sort of valve-like tongue to the efferent branchial canal, beyond which it projects; its epipodite also, which is a prolongation of the exopodite, is very large.

The 2nd maxillipeds have neither exopodite nor epipodite: they are pediform and six-jointed—the basis and ischium being fused—and their dactylus is spini-form.

The external maxillipeps have no exopodite, but they may have an epipodite: they are pediform and 7-jointed, though there is no independent motion between the basis and ischium.

The thoracic legs are all seven-jointed: the first four pairs are always chelate and the fifth pair also are often so: the first pair is very much longer



than the others. The first four pairs carry epipodites which may be of good length or may merely be membranous expansions of the base of the podobranchiæ.

The abdominal appendages behind the first pair are biramous, with the rami narrowly foliaceous, and with an internal appendix at the base of the endopodite. The 1st pair are uniramous and in the male have the form of a slender scoop. In the male also the 2nd pair have an additional internal appendix.

*Synopsis of the genera of Eryonidæ of the Indian Necton and Benthos.*

- I. Eystalks immovably impacted in deep sinuses of the anterior border of the carapace: the fixed finger of the large chelipeds without any enlarged tooth:—
- i. Carapace depressed, with sharply defined lateral borders: inner antennular flagellum longer than the carapace:—
    1. The epipodite of the external maxillipeds is a mere papilla; those of the thoracic legs are merely membranous expansions of the base of their podobranchiæ ... POLYCHELES.
    2. The epipodite of the external maxillipeds is of fair size; those of the thoracic legs are normal epipodites ascending into the branchial chamber ... .. PENTACHELES.
  - ii. Carapace inflated, globose, longer than the abdomen: inner antennular flagellum much shorter than the carapace ... ERYONICUS.
- II. Eystalks immovably fixed beneath and parallel with the anterior border of the carapace: the fixed finger of the large chelipeds with a large spiniform tooth near its distal end: carapace depressed, with sharply defined lateral borders: inner antennular flagellum nearly as long as the body: external maxillipeds and first pair of thoracic legs with long epipodites ... WILLEMOESIA.

There seems to be some little doubt as to the right nomenclature of the various species of this group.

The *Polycheles* described and figured by Heller (1862) has orbital sinuses and has no epipodite to the external maxillipeds: in this *Mémoire*, therefore, the name *Polycheles* is applied to the species thus characterized, in which also the epipodites of the thoracic legs are merely membranous expansions of the bases of the podobranchiæ.

The genus *Pentacheles* of Spence Bate (1878) is by its author characterized by the form of the last pair of thoracic legs, which are “more or less perfectly chelate in both sexes.” But it is characteristic of the family as a whole for the male—*Willemoesia* is, as far as I know, the only exception—to have the last pair of legs less perfectly chelate than the female, and on this account recent authors have refused to recognize *Pentacheles* as a distinct genus. In some of the species allotted to this genus by Spence Bate, however, the external maxilli-

pedes are described as having an epipodite, and the epipodites of the thoracic legs are described as long and broad. In this Memoir, therefore, the name *Pentacheles* is applied to the species (having the eyes imbedded in orbital notches) in which the external maxillipeds have a recognizable epipodite, and the first 4 pairs of legs have normal epipodites ascending into the branchial chamber.

### POLYCHELES, Heller.

*Polycheles*, Heller, Sitzungsab. Akad. Wien, XLV. 1862, i. p. 389, and Crust. südl. Europ., p. 209: Spence Bate, Challenger Crust. Macrura, p. 126: Faxon, Mem. Mus. Comp. Zool. XV111. 1895, p. 117.

*Stereomastis*, Spence Bate, Challenger Crust. Macrura, p. 154.

Carapace nearly as long as the abdomen, elongate-subquadrilateral or truncate-oval, usually depressed: its lateral borders are sharply defined as in *Brachyura*, marking off (1) a dorsal surface, which is longitudinally carinated in the middle line, and (2) a side-wall, which is traversed fore and aft by two oblique ridges, one running to the base of the antennæ and corresponding with the epimeral suture of the crab's carapace, the other running to the base of the 1st pair of thoracic legs. The cervical groove is well defined. The rostrum is represented by a small spine or pair of small spines, its place being supplied by an acute rigid prolongation of the inner border of the basal joint of the antennules. In the frontal border, on either side, is a deep sinus, which is filled by the immovable eye-stalk. The posterior border of the carapace is concave, and the posterior angles of the carapace are nipped between two pegs at the outer angles of the 1st abdominal somite, each peg fitting into a distinct socket.

The abdomen is depressed and tapering, the telson, which is about as long as the caudal swimmerets, being acute. The abdominal somites articulate with one another by little hinge-joints situated near the tergo-pleural junction: the terga are carinated in the middle line: the pleura of the 2nd somite are large and auriculate. The exopodite of the tail-fan is not transversely fissured.

The eyestalks are immovably impacted in the orbital notches: their greater part is well calcified, but the part that fits the bottom of the notch is thin and translucent and appears to represent the remains of the eye. From the frontal end of the eye-stalk a slender blunt process runs outwards, at right angles, beneath the antero-lateral lobe of the carapace: its somewhat translucent tip may perhaps be the remains of the eye.

The basal joint of the antennular peduncle has its inner angle produced to form a sharp stiff lamina resembling (but usually larger than) the antennal scale: of the two antennular flagella the inner one resembles, in form and length, the antennal flagella, being longer than the carapace, while the outer one is short and not stouter than the inner, even in the male.

The antennal scale is an acute narrow lamina, not overlapping the antennal

peduncle: the renal tubercle of the basal joint of the peduncle is extremely prominent, impinging on the basal joint of the antennular peduncle.

The 2nd maxillipeds have no epipodite, and that of the external maxillipeds is represented at most by a papilla. Epipodites are present on the first 4 pairs of thoracic legs, but they are only membranous expansions of the base of the podobranch, and ascend little or not at all into the branchial chamber.

The external maxillipeds are pediform and are shorter and slenderer than any of the thoracic legs.

All the thoracic legs are chelate in the female, and in the male all but the last pair which are, in varying degrees, imperfectly chelate. The 1st pair are about as long as the body, and have their joints strongly compressed: the ischium is curved, the merus is broadened in its proximal third, the carpus is club-shaped, the hand is elongate, with long slender fingers hooked at tip and microscopically pectinate along their opposed edges. The other 4 pairs are short.

The eggs are numerous and small.

The branchial formula is as follows:—

Somites and Appendages.	Podobranchia.	Arthrobranchia.	Plenrobranchia.	
VII	(ep.)	0	0	= 0 ep.
VIII	0	0	0	= 0
IX	(ep. r.)	1	0	= 1+ep. r.
X	1 (ep.)	2	0	= 3+ep.
XI	1 (ep.)	2	1	= 4+ep.
XII	1 (ep.)	2	1	= 4+ep.
XIII	1 (ep.)	2	1	= 4+ep.
XIV	0	0	1	= 1
Total	4 + 5 ep. + ep. r.	9	4	= 17 + 5 ep. + ep. r.

The epipodites of the thoracic appendages are only membranous expansions of the base of their podobranchs. The arthrobranch of the external maxillipeds is small and occasionally is absent altogether.

#### Key to the Indian species of *Polycheles*.

- I. The carina of the 5th abdominal tergum does not culminate anteriorly in a spine: a single spinule is present at the outer angle of the basal joint of the antennular peduncle ... .. *P. phosphorus*.
- II. The carina of the 5th abdominal tergum culminates in an antorse spine: 2 spinules are present at the outer angle of the basal joint of the antennular peduncle:—
  1. The median carina of the carapace carries 4 spines (the penultimate of which is double) between the rostral spines and the cervical groove:—
    - i. The antorse spine in which the carina of the 5th abdominal tergum culminates is not larger than that of the 4th abdominal tergum ... .. *P. andamanensis*.

- ii. The antrorse spine in which the carina of the 5th abdominal tergum culminates is of enormous size, its tip overhanging the *anterior* border of the 4th tergum ... *P. ceratus*.
2. The median carina of the carapace carries 3 spines (the penultimate of which is double) between the rostral spines and the cervical groove ... .. *P. sculptus*.

### 96. *Polycheles phosphorus*, Alcock.

*Pentacheles phosphorus*, Alcock, Ann. Mag. Nat. Hist., March 1894, p. 240.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE VIII, FIG. 2.

Carapace everywhere covered with a hairy tomentum, beneath which, except for certain definitely placed spines, it is smooth: the antennular and antennal peduncles, the edges of the last four pairs of thoracic legs and of the abdominal pleura and tail-fan are setose.

Carapace elongate-quadrate, depressed, its lateral borders parallel except at the four corners, its length in the middle line about half a telson-length less than that of the abdomen. Its frontal border is concave, with the orbital notches deep and armed with a spine at their inner angle only. Its lateral borders are armed with 15 or 16 spines, namely 6 (rarely 7) + 3 (rarely 4) in front of the cervical groove, and 6 or 7 behind it. It is dorsally carinated in the middle line from the anterior border, where the carina begins in a pair of juxtaposed rostral spines, to the posterior border, where it splits and ends in a pair of separated spines, which are the only spines on that border. *Besides* these spines at either end, the carina carries in front of the cervical groove 4 spines the penultimate of which is double, and behind the cervical groove 2 double spines. On either side of the carapace the following spines are found: one on the eyestalk, near its frontal end; 3 in an oblique row, behind the orbital notch; one at the bifurcation of the cervical groove, and a pair at the end of the short anterior branch of the groove; a longitudinal row of spines parallel with the posterior half of the lateral border; and some spines flanking the cardiaco-branchial groove. The two obliquely longitudinal ridges of the sidewalls of the carapace are also spinose.

All the abdominal terga (including the true tergal element at the base of the telson) are longitudinally carinated in the middle line. The carinæ of the first 4 terga culminate anteriorly each in an overhanging antrorse spine, that of the 5th tergum ends abruptly, and that of the 6th tergum is double and granular. At either end of the anterior border of the exposed surface of the 1st abdominal somite are two spines.

Antennular scale a little larger than the antennal scale, its length being about two-sevenths that of the carapace: at the outer angle of the basal joint of the antennular peduncle is a single spinule. The narrow antennal scale reaches to the end of the antennal peduncle.



The external maxillipeds reach to the end of the antennular peduncle.

The 1st pair of thoracic legs are slightly longer than the entire body: on the upper border of the merus are 1 or 2 spines, and on the lower border 1 or 2 spines and some spinules: a claw-like spine is present at the far end of the upper border of the merus and palm, and of both borders of the carpus: the lower border of the palm is finely serrated: the whole hand is a little longer than the merus, and the fingers, which are about as long as the carpus, are about one-third as long again as the palm.

The 2nd-5th pairs of legs diminish in length, and very slightly in stoutness also, in posterior succession, the 2nd pair being little more than a third the length of the 1st pair: in the female all are perfectly chelate, but in the male the last pair are imperfectly so.

Colour in life, bright pink.

In a large female the length of the carapace in the middle line is 54 millim., of the abdomen 65 millim., and the length of the 1st pair of thoracic legs is 130 millim.

From the Andaman Sea, 370-419, 375, 405, 490 and 500 fathoms; Bay of Bengal, 200-350, 561 and 678 fathoms; Arabian Sea and G. of Manár, 295, 406, 445, 480, 487, 550, 595, 675, 696 and 740 fathoms.

One of the females taken in 561 fathoms was luminous at two points between the last pair of thoracic legs, where there is a triangular glandular patch.

Regd. Nos.  $\frac{6873}{9}$  (Type of the species) :  $\frac{8513}{6}$  :  $\frac{39}{7}$  :  $\frac{521-22}{7}$  :  $\frac{3220}{9}$  :  $\frac{6015}{9}$  :  $\frac{6872}{9}$  :  $\frac{6875}{9}$  :  $\frac{6877-79}{9}$  :  $\frac{8793}{9}$  :  $\frac{9311-13}{9}$  :  $\frac{47-48}{10}$  :  $\frac{793}{10}$  :  $\frac{1390}{10}$  :  $\frac{1393-95}{10}$  :  $\frac{2524}{10}$  :  $\frac{3812}{10}$  :  $\frac{3814-15}{10}$  :  $\frac{3820}{10}$  :  $\frac{3858}{10}$ .

### 97. *Polycheles andamanensis*, Alcock.

*Pentacheles andamanensis*, Alcock, Ann. Mag. Nat. Hist., March 1894, p. 239.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE X. FIG. 3.

Very closely resembles *P. phosphorus*, from which it differs only in the following characters:—

The carina of the 5th abdominal tergum culminates anteriorly in a spine, which is as large as those of the 3rd and 4th terga.

At the outer angle of the basal joint of the antennular peduncle there are two spinelets.

The narrow antennal scale does not reach the end of the antennal peduncle.

In the female the large chelipeds are a little shorter than the body, and the lower border of the merus and palm are perfectly smooth.

In the single female specimen the spines of the lateral border of the carapace are 4 or 5 + 3 + 6.

Colour in life, pink.

Off the Travancore coast, 1043 fathoms.

The specific name *andamanensis* is the result of a mistake.

Regd. No.  $\frac{532}{7}$  (Type of the species).

### 98. *Polycheles ceratus*, Alcock.

*Pentacheles ceratus*, Alcock, Ann. Mag. Nat. Hist., March 1894, p. 241.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE VIII. FIG. 1.

Differs from *P. phosphorus* only in the following characters:—

The carapace is very little longer than the first 6 abdominal somites. Its lateral borders are armed, in front of the cervical groove with 6 + 2 spines, but behind the cervical groove there are only 2 or 3 spines large enough to be seen by the naked eye. In front of the cervical groove the median carina is armed as in *P. phosphorus* with 2 + 1 + 1 + 2 + 1 spines, but behind the cervical groove there are only 2 pairs of spines *including* the pair on the posterior border. There is no spine at the inner angle of the orbital notch, and none at the frontal end of the eye-stalk. There is a spine at the bifurcation of the cervical groove on either side, and there is a fine and slightly sinuous ridge parallel with the posterior half of either lateral border, but otherwise the carapace is smooth.

The carina of the 5th abdominal tergum ends in a huge antrorse claw-like spine the point of which overhangs the *anterior* border of the 4th tergum.

There are no spines at the outer ends of the 1st abdominal tergum.

There are 2 spinelets at the outer angle of the basal joint of the antennular peduncle.

The large chelipeds are perfectly smooth, except for the terminal spines of the merus, carpus, and palm.

In an egg-laden female the length of the carapace in the middle line is 3.4 millim., of the abdomen 4.5 millim., and that of the large cheliped is 8.9 millim.

From the Andaman Sea, 922 fathoms.

Regd. No.  $\frac{6880}{9}$  (Type of the species).

### 99. *Polycheles sculptus*, S. I. Smith.

*Polycheles sculptus*, S. I. Smith, Proc. U. S. Nat. Mus. 1879 (1880) II. p. 345, pl. vii. and Ann. Mag. Nat. Hist.

(5) V. April 1880, p. 269: Caullery in Ann. Univ. Lyon, 1896, p. 385.

*Pentacheles sculptus*, S. I. Smith, Bull. Mus. Comp. Zool. X. 1882, p. 23, pl. iii.-iv: and Albatross Crust. in Rep. U. S. Fish. Comm. for 1882 (1884), p. 358, and 1885 (1886), p. 46: A. Agassiz, Bull. Mus. Comp. Zool. XV. 1888, p. 42, fig. 239: Alcock and Anderson, Ann. Mag. Nat. Hist. (7) III. 1899, p. 289.

*Polycheles spinosus*, A. Milne Edwards, Bull. Mus. Comp. Zool. VIII., Dec. 1880, p. 66.

Differs from *P. phosphorus* only in the following characters:—

The median carina of the carapace carries, between the rostral spines and

the cervical groove, only 1 + 2 + 1 spines, instead of 1 + 1 + 2 + 1. Behind the cervical groove, the oblique groove that delimits the cardiac region on either side is not flanked by spines. There is no spine at the frontal end of the eye-stalk.

The median carina of the 5th abdominal tergum culminates anteriorly in an antrorse spine similar to, but smaller than, that of the 4th.

There are two spinelets at the outer angle of the basal joint of the antennular peduncle.

In the large chelipeds there are no enlarged spines, but only spinules, on the lower border of the merus; the hand is hardly as long as the merus, and the fingers are shorter than the carpus and not a fourth as long again as the palm.

In a large male the length of the carapace in the middle line is 52 millim., of the abdomen, 70 millim., and that of the large cheliped is 141 millim.

Colour in life rosy pink.

Arabian Sea, 738, 824, 836 fathoms.

Regd. Nos.  $\frac{536}{7} : \frac{1961-1964}{10} : \frac{2364}{10}$ .

#### PENTACHELES, Spence Bate.

*Pentacheles*, Spence Bate, Ann. Mag. Nat. Hist. (5) 11. 1878, p. 276, and Challenger Crust. Macrura, p. 143.

Differs from *Polycheles* only in the following particulars:—

The external maxillipeds carry a functional epipodite, and the epipodites of the first four pairs of thoracic legs are independent plates, attached to the podobranchiæ at base only, and ascending into the branchial chamber in normal fashion. The epipodite of the external maxillipeds may be long or short, but is never a mere rudiment as in *Polycheles*: similarly the epipodites of the legs are of variable length, sometimes ascending a short way into the branchial chamber, sometimes nearly reaching the roof.

#### Key to the Indian species of *Pentacheles*.

- I. Posterior border of the carapace spinose: each orbital sinus is divided into two parts by a serrated lobe stretching across from the inner border of each ... .. *P. Hextii*.
- II. Posterior border of the carapace smooth: orbital sinuses simple, not divided:—
  1. Both angles of the orbital sinuses are armed with a spine: the carinæ of the abdominal terga are entire ... .. *P. Beaumontii*.

2. The angles of the orbital sinuses are smooth : most of the carina of the abdominal terga are deeply notched :—
- i. Carapace depressed : the abdominal terga and pleura with a very few scattered vesiculous granules ... *P. Carpenteri*.
  - ii. Carapace decidedly convex : the abdominal terga and pleura with sharp miliary tubercles ... .. *P. gibbus*.

### 100. *Pentacheles Hextii*. Alcock.

*Pentacheles Hextii*, Alcock, Ann. Mag. Nat. Hist., March 1894, p. 237.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE X. FIG. 2.

Carapace covered with a hairy tomentum, beneath which it is beset everywhere with spinules and sharp granules in addition to certain definitely placed spines.

Carapace elongate-quadrilateral, depressed, its lateral borders nearly parallel except at the four corners, its length about half a telson-length less than that of the abdomen. Its frontal border is concave, and in addition to a simple rostral spine and to a strong spine at the inner angle of either orbital notch and another at the frontal end of either impacted eye-stalk, is armed with several spines at either outer orbital angle. The orbital notches are quite peculiar in being divided each into two portions by a serrated lobe that stretches across from the inner border of each, the anterior portion contains the calcified part, the posterior portion contains the thin translucent part of the eye-stalk.

The lateral borders of the carapace are armed with from 26 to 31 spines, namely, 7 or 8 + 5 in front of the cervical groove and 14 to 18 of gradually diminishing size behind it. The posterior border is armed with some antrorse spines.

The dorsal carina begins in a simple rostral spine and ends in a pair of spines on the posterior border of the carapace : it is closely and sharply granular with some irregularly disposed spines of larger size, and behind the cervical groove is distinctly double.

On either side of the carapace a line of spines behind the orbital notch defines the gastric region, and a closely-spinose ridge runs parallel with the posterior half of the lateral border. The ridge also that defines the cervical groove is spinose.

The abdominal terga and pleura have their edges serrated and their surface more or less studded with vesiculous granules. All the terga are longitudinally carinated in the middle line : the carina of the 1st is faint and hardly distinguishable from the neighbouring serrations, that of the 6th is granular and double, those of the 2nd–5th are sharp and culminate anteriorly each in an antrorse spine.



The antennular scale is narrow and acute: there are two spinelets at the outer angle of the basal joint of the antennular peduncle.

The antennal scale is narrow and does not reach the end of the antennal peduncle.

The 1st pair of thoracic legs are a little shorter than the body: the upper border of the merus is spinose and the lower border spinulose, the upper border of the carpus is spinulose and both borders of the palm are serrated: the usual spine or tooth is found at the far end of the upper border of the merus and palm and of both borders of the carpus: the whole hand is a little longer than the merus, and the palm is about as long as the wrist, the fingers being about one-third longer.

In the female all five pairs of thoracic legs are perfectly chelate, but in the male the 5th pair are nearly simple.

The epipodites of the external maxillipeds are short and little setose: those of the thoracic legs are of moderate length.

Colour in life, pink.

In the largest female the length of the carapace in the middle line is 43 millim., of the abdomen 54 millim., that of the large chelipeds 89 millim.

Andaman Sea 188 to 220 fathoms; Arabian Sea, 224 to 284 and 719 fathoms.

Regd. Nos.  $\frac{6767-6770}{9}$  (Types of the species):  $\frac{8794}{9}$ :  $\frac{3433}{10}$ .

### 101. *Pentacheles gibbus*, Alcock.

*Pentacheles gibbus*, Alcock, Ann. Mag. Nat. Hist., March 1894, p. 234.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE VIII. FIG. 4.

The carapace, although its outlines are quite normal, is decidedly convex dorsally in the adult and very strongly so in the young, its surface when denuded is granular with some scattered spinules. Its frontal border is concave with no spines except the rostral pair and a scrobiculate spine at the frontal end of the impacted eye-stalk. The orbital sinuses are triangular and shallow. The lateral borders of the carapace are slightly convergent anteriorly and are armed with about 25 spines, namely, 5 or 6 + 3 in front of the cervical groove, and about 17 of diminishing size behind it. The median dorsal carina is granular and irregularly spiny and more or less distinctly double, in all its course. The posterior border of the carapace is perfectly smooth. There are some spinules on the ridge that bounds the cervical groove, but no other definitely placed spines; and there is no ridge running parallel with the postero-lateral borders on either side, or only traces of one.

There are some sharpish miliary tubercles on the dorsal and lateral surfaces of the abdomen, but the edges of the pleura are perfectly smooth. The abdominal terga are longitudinally carinated in the middle line: the carina of the 1st tergum is little more than a compressed tooth, that of the 6th is little more than a broken line of granules, but those of the 2nd-5th are of good height and have their free edge eroded and deeply notched, so as to appear bilobed in a side-view.

The antennular scale is vastly longer than the antennal, being a sharp triangular lobe of such size that in repose the scales of opposite sides are in contact with one another all along the inner border, which is upturned and serrulate. There is a single spinelet at the outer angle of the basal joint of the antennular peduncle.

The slender antennal scale does not reach the end of the antennal peduncle.

The 1st pair of thoracic legs is not quite as long as the body: the merus is more than ordinarily dilated at its basal end, and both its borders are finely spinulose distally; the lower border of the palm is spinulose throughout, and there is a spine at the far end of the upper border of the merus and palm and of the lower border of the carpus: the hand is much longer than the merus, and the fingers, which are decidedly shorter than the carpus, are about as long as the palm. The 5th pair are imperfectly chelate in the male.

The epipodites of the external maxillipeds are long, and those of the thoracic legs ascend high into the branchial chamber.

Colour in life, bright pink.

In the largest male the length of the carapace in the middle line is 62 millim., of the abdomen 74 millim., of the large pair of chelipeds 129 millim.

Andaman Sea, 922 fathoms; Arabian Sea 912 to 931 fathoms.

Regd. Nos.  $\frac{6799-6800}{10} : \frac{46}{10} : \frac{792}{10}$  (Types of the species).

## 102. *Pentacheles Carpenteri*, Alcock.

*Pentacheles Carpenteri*, Alcock, Ann. Mag. Nat. Hist., March 1894, p. 235.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE X. FIG. 1.

Closely resembles *P. gibbus*, from which it differs in the following characters:—

The carapace is depressed, as in all other species of the genus. Its lateral borders are armed with from 25 to 27 spines, namely, 4-6 + 3 in front of the cervical groove and 16-20 (of which only the anterior 3 or 4 are of any size) behind it. On either side of the carapace there are two enlarged spines, one behind the other, between the orbital notch and the cervical groove.

There are only a few granules on the abdominal pleura and almost none on the terga. The median carina of the 6th abdominal tergum is even more incomplete.

In the large chelipeds the fingers are longer than the carpus and longer than the palm.

In all other respects this species agrees with *P. gibbus*.

In the unique specimen the length of the carapace in the middle line is 38.5 millim., of the abdomen 48.5 millim., of the large chelipeds 82 millim.

From the open part of the Bay of Bengal, on the slope of Carpenter's Ridge: 1370-1540 fathoms.

Regd. No.  $\frac{76}{7}$  (Type of the species).

### 103. *Pentacheles Beaumontii*, Alcock.

*Pentacheles Beaumontii*, Alcock, Ann. Mag. Nat. Hist., March 1894, p. 236.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE VIII. FIG. 3.

Carapace depressed, its lateral borders parallel in their posterior half, curved and convergent anteriorly, its surface when denuded is finely granular, without any large spines, except a few on the dorsal carina. The frontal border is concave and presents, in addition to a pair of rostral spines, a strong spine at either angle of either orbital notch, and a spine at the frontal end of the impacted eye-stalk. Its lateral borders are armed with about 23 or 24 spines, namely 7 or 8 + 3 in front of the cervical groove and 12 or 13 behind it. Its posterior borders are perfectly smooth. The dorsal carina is finely granular and double and has no large spines except a few where it traverses the middle of the gastric region. Behind the cervical groove, skirting the lateral border, on either side, is a fine granular ridge. Of the two ridges of the sidewalls of the carapace the dorsad one is distinct only in front of the cervical groove.

The abdominal integument is smooth to the naked eye, and the edges of the terga and pleura are smooth. The 1st-5th terga are carinated in the middle line the carinae of the first 3 terga culminating anteriorly in an antrorse spine. The 6th tergum is quite smooth.

The antennular scale appears to have been of the broad type of *P. gibbus* and *Carpenteri*. There is a single spine at the outer angle of the basal joint of the antennular peduncle.

The slender antennal scale almost reaches the end of the antennal peduncle.

The large chelipeds (in the male) are more than a telson-length longer than the body: the lower border of the merus is spinose, some of the spines being of fair size, and the upper border spinulose, and both borders of the palm are spinulose: at the far end of the upper border of the merus and palm and of

both borders of the carpus is a spine: the hand is a little longer than the merus, and the fingers are as much longer than the palm as they are shorter than the carpus. The 5th pair of thoracic legs are imperfectly chelate in the male.

The epipodites of the external maxillipeds are long, and those of the thoracic legs ascend a good way into the branchial chamber.

In the unique male the length of the carapace in the middle line is 36.5 millim., of the abdomen 44 millim., and that of the large chelipeds is 94 millim.

From off Colombo, 675 fathoms.

Faxon regards this species as, at most, a geographical race of *P. granulatus* from the neighbourhood of the Gulf of Panama.

Regd. No.  $\frac{520}{7}$  (Type of the species).

### *Eryonicus*, Spence Bate.

*Eryonicus*, Spence Bate, Ann. Mag. Nat. Hist. (5) X. 1882, p. 457, and Challenger Crust. Macrura, p. 122: Faxon, Mem. Mus. Comp. Zool., XVII. 1895, p. 108.

In all essential characters this genus resembles *Polycheles*, from which it differs in having (1) the carapace globosely inflated and longer than the abdomen, (2) the inner (longer) antennular flagellum much shorter than the carapace, (3) the renal tubercle of the basal joint of the antennular peduncle much more prominent, (4) the 1st pair of thoracic legs—though of quite the same form—shorter, and (5) the integuments submembranous.

As in typical *Polycheles*, the epipodite of the external maxillipeds is a mere papilla, and those of the thoracic legs (1st 4 pairs) are merely membranous expansions of the bases of the podobranchiæ.

As in *Polycheles* and *Pentacheles*, the eyes are immovably impacted in deep sinuses of the anterior margin of the carapace, though they do not so completely fill the sinuses.

And as in all recent *Eryonidæ*, the posterior angles of the carapace are firmly bolted to the 1st abdominal somite.

I agree with Faxon that the species of *Eryonicus* probably belong to the "Meteoric" (Nectic) fauna.

### 104. *Eryonicus indicus*, Alcock and Anderson.

<sup>1</sup> *Pentacheles* (? immature), Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 199.

*Eryonicus indicus*, Alcock and Anderson, Ann. Mag. Nat. Hist., April 1899, p. 290.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE L. FIG. 3.

Carapace globose, ovoid but posteriorly truncate, longer than the abdomen. On its anterior margin are a pair of rostral spines, a spine at either angle of



either orbital notch, and a spine on the impacted eyestalk. The ridges that correspond with the lateral borders of *Polycheles* are spinose throughout, the spines increasing in size posteriorly up to a very large terminal one: the ventral submarginal ridges also—running from the postero-lateral angles of the carapace to the bases of the large chelipeds—are conspicuously spinose. In the middle line of the carapace is a carina on which some large spines stand, to the number of 9 (not including the rostral pair) of which the 3rd, 6th, 7th and 9th are double.

The abdominal terga, including the tergal element of the telson, all carry a median upstanding spine, the middle three of which have each a spinelet at base. There is a similar spine at either outer end of the abdominal terga, and one on each pleuron. The edges of the pleura, telson, and caudal swimmerets are spinulose.

The eyestalks are impacted in the orbital sinuses, and from their antero-external end a blunt conical process, which may be the remains of the eye, projects.

The antennular scale is narrowish and projects beyond the peduncle: the basal joint of the peduncle has a spine at its outer angle: the inner (longer) antennular flagellum is about half the length of the carapace. The narrow antennal scale hardly reaches the end of the antennal peduncle: the renal tubercle is an incurved styliform process of extraordinary length.

The 1st pair of thoracic legs have the joints compressed, the ischium curved, and the merus expanded at its proximal end, as in *Polycheles*: their length is about equal to that of the carapace and first 5 abdominal somites combined: the merus has some spinules along both borders and a spine at the far end of the upper border, the club-shaped carpus has a spine at the far end of both borders, and the palm has a spine at the far end of the upper border: the hand is nearly as long as the combined ischium and merus, the palm is a little longer than the wrist, but considerably shorter than the fingers: the fingers are slender, strongly hooked at tip, and microscopically pectinate along the opposed edges.

The 2nd–5th thoracic legs decrease slightly in length in posterior succession, the 2nd pair being about  $\frac{4}{5}$ ths the length of the 1st. All are chelate in the female, but in the male the 5th pair is imperfectly so.

Colours in life, pink; or the carapace may be brownish, the abdomen dirty white and the antennæ and ends of the legs pink.

In the largest specimen the length of the carapace is 25 millim., of the abdomen 21 millim., of the large chelipeds 35 millim.

Arabian Sea, off C. Comorin 480, 487 and 824 fathoms; Bay of Bengal, 690–920 fathoms.

Regd. No.  $\frac{2423}{10}$  (Type of the species):  $\frac{6016}{9}$ :  $\frac{3408}{10}$ :  $\frac{3804}{10}$ .

## WILLEMESIA, Grote.

*Deidamia* Willemoes-Suhm, Nature VIII. 1873, p. 51.

*Willemesia*, Grote, Nature VIII. 1873, p. 485: Spence Bate, Challenger Crust. Macrura, p. 162.

Closely resembles *Polycheles* from which it differs in the following characters.

The eyes, though immovably fixed and non-pigmented and non-faceted as in *Polycheles*, &c., are not impacted in sinuses of the anterior region of the carapace, but are fixed just beneath and parallel with the anterior border of the carapace.

The inner (longer) antennular flagellum, like the antennal flagellum, is nearly as long as the body, and the outer antennular flagellum, though short as in *Polycheles*, is sometimes in the male very much thickened.

The epipodites of the external maxillipeds and of the thoracic legs (1st four pairs) are long, longer even than in *Pentacheles*.

The 1st pair of thoracic legs, though of the same form as those of *Polycheles* and having the joints similarly shaped, are longer, and the fixed finger carries near the far end of the opposed border a large spine-like tooth.

The last pair of thoracic legs are as perfectly chelate as the other pairs, in both sexes.

The branchial formula is the same as that of *Polycheles*, but the arthrobranch of the external maxillipeds is larger.

105. *Willemesia indica*, n. sp. Plate I. fig. 1.

Carapace about half a telson-length shorter than the abdomen, its lateral borders parallel in their posterior half and slightly convergent anteriorly, its surface when denuded is covered with sharp granules. The frontal border is concave, with a small rostral spine and on either side of it a tooth. The lateral borders are armed with numerous spines, namely, 7 or 8 + 5 or 6 in front of the cervical groove, and from 15 to 20 behind it—these last being small and not very conspicuous. The posterior border is quite smooth. The dorsal carina is irregularly serrated. The ridge defining the cervical groove is smooth. In front of the cervical groove two longitudinally-sinuose spinulose ridges define the gastric region, and behind it two similar ridges traverse the branchial region.

The abdominal terga and pleura, though having the surface non-granular and the edges smooth, are sculptured, especially the 6th tergum. The first 5 terga are longitudinally carinated in the middle line, the carina of each ending anteriorly in an antrorse spine: the 6th tergum has a lyre-shaped carina.

The antennular scale is broadly triangular with the inner edge vertically up-turned: its tip does not reach further than the end of the 2nd joint of the

antennular peduncle: there is no spine at the outer angle of the basal joint of the peduncle.

The slender antennal scale is decidedly shorter than the vertically-compressed antennal peduncle.

The eyes are borne on short eyestalks which are immovably fixed, in the transverse axis of the carapace, in shallow fossæ lying beneath the anterior border of the carapace.

The 1st pair of thoracic legs are much longer than the body: the lower border of the merus and of the fixed finger, the upper border of the carpus, and both borders of the palm are spinose, and the opposed border of the fixed finger has a large spiniform tooth near its distal end: the upper border of the merus and palm, and both borders of the carpus, have a spine or tooth at the distal end: the club-shaped carpus is about twice as long as the palm, and the palm is a little shorter than the fingers. All the other thoracic legs are short.

Colour in life either pale pink or milk-white.

In the largest specimen the length of the carapace is 54 millim., of the abdomen 71 millim., measured in the middle line.

From the Bay of Bengal, 1310, 1439, 1748 and 1803 fathoms.

This species seems to come nearest to *Willemøisia inornata* Faxon. From the peculiar delicacy of its tissues, and also from the fact that on one occasion a specimen was brought up in a trawl that we believed to have not touched bottom, I am of opinion that it belongs to the Nectic fauna.

Regd. No.  $\frac{6871}{9}$  (Type of the species):  $\frac{6012-6014}{9}$ :  $\frac{6870}{9}$ .

### Family *Scyllaridae*, White.

Dana, Proc. Ac. Nat. Sci. Philad. 1852, p. 14, and U. S. Expl. Exp. Crust. pt. I., p. 516: Spence Bate, Challenger Crust. Macrura, p. 57: Stebbing, Hist. Crust., p. 191: Ortmann in Bronn's Thier Reich (Malacostraca), p. 1137.

Carapace strongly depressed, with well defined lateral borders and with the rostrum absent or represented only by a tooth: anteriorly it is soldered to the epistome on either side, posteriorly its angles are firmly held between the last thoracic epimeron and the 1st abdominal somite. Thoracic sternum broad.

Abdomen broad, the terga overlapping, the pleura behind the 1st well developed: telson quadrate, its posterior portion, like the greater part of the caudal swimmerets is coriaceous or membranous.

The eyes are lodged in perfect orbits, excavated either in the dorsum or in the lateral border of the carapace.

Antennular peduncle elongate, weak, with cylindrical joints: the flagella short.

The antennæ are profoundly modified: from the dorsal view each consists of a pair of large laminæ which appear to represent the 3rd and 5th joints of the peduncle: there is no antennal scale and the basal joint of the peduncle is merged in the epistome.

The 2nd maxillæ and 1st maxillipeds appear to take no part in manducation.

All the maxillipeds have exopodites and epipodites: the external maxillipeds are pediform and six-jointed, the basis and ischium being fused.

The thoracic legs are six-jointed, the basis and ischium being fused: none are enlarged and none are chelate except the 5th pair in the female which is more or less perfectly so: the first four pairs carry large foliaceous epipodites.

The 1st abdominal somite is, in both sexes, destitute of appendages.

This family is represented in the depths of these seas by two species of the genus *Arctus*.

#### ARCTUS, Dana.

*Arctus*, Dana, Proc. Acad. Nat. Sci. Philad., 1852, p. 14, and U. S. Expl. Exp., Crust., pt. I., p. 516: Spence Bate, Challenger Crust. Macrura, p. 66.

Carapace depressed, shorter than the abdomen, its greatest breadth equal or nearly equal to its length: the ophthalmic and antennal terga though an integral part of it, are distinctly recognizable: its posterior angles are firmly held between a stud-like facet of the last thoracic epimeron below, and the incurved angle of the rudimentary 1st abdominal pleuron above.

Eyes of good size, orbits dorsal and situated nearer to the antero-lateral angle of the carapace than to the middle line. Antennular flagella extremely short. Antennæ not in contact with one another.

The mandible carries a short setose palp and has no separate molar process. The 1st maxillæ consist of a slender curved coxopodite and basipodite, without palp. The 2nd maxillæ consist of an enormous scaphognathite with the other parts rudimentary. In the 1st maxillipeds the coxopodite is absent, the basipodite and endopodite small, and the epipodite and exopodite large and foliaceous, the exopodite forming a sort of tongue-like valve in the efferent branchial channel. In the 2nd maxillipeds the exopodite is foliaceous and much larger than the endopodite and projects at the efferent branchial opening: the endopodite is pediform and six-jointed, and a slender epipodite is present. The external maxillipeds are pediform and six-jointed: their exopodite is slender and has no flagellum.

The 1st abdominal somite is destitute of appendages, the 2nd has them well developed in both sexes, while on the 3rd-5th somites they are present in the female but are sometimes rudimentary or absent in the male.



The branchial formula is as follows :—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.	Pleurobranchiæ.		
VII	(ep.)	0	0	=	ep.
VIII	(ep.)	0	0	=	ep.
IX	1 (ep.)	2	0	=	3+ep.
X	1 (ep.)	2	0	=	3+ep.
XI	1 (ep.)	2	1	=	4+ep.
XII	1 (ep.)	2	1	=	4+ep.
XIII	1 (ep.)	2	1	=	4+ep.
XIV	0	0	1	=	1
Total	5 + (7 ep.)	10	4	=	19 + 7 ep.

*Key to the species of Arctus of the Indian Oligobenthos.*

- I. Thoracic sterna smooth, 4th pair of thoracic legs the longest—a good deal longer than the carapace ... .. *A. orientalis*.
- II. Thoracic sterna with a median tubercle: 2nd pair of thoracic legs longer than the 4th pair and shorter than the carapace ... .. *A. rubens*.

106. *Arctus orientalis*, Spence Bate.

*Arctus orientalis*, Spence Bate, Challenger Crust. Macrura, p. 68, pl. ix., fig. 4: Alcock and Anderson, Journ. As. Soc. Bengal, Vol. LXIII, 1894, pt. 2, p. 165.

Carapace, measured in the middle line, about as long as the abdomen without the telson, its length about equal to its greatest breadth at the antero-lateral angles: its lateral margins are serrulate and are cut into three lobes—an orbital, an hepatic, and a branchial: it is dorsally traversed by 3 longitudinal carinæ—a median, and one running from either inner-orbital angle—which are coarsely crenulate but carry no salient teeth: its surface carries some small tubercles, the most conspicuous of which define the cardiac region laterally: its posterior border, which is separated from the rest of the carapace by a deep fissure, is very slightly notched in the middle line.

Thoracic sternum deeply concave, without any median series of tubercles.

On the abdominal terga and pleura there are some small squamiform tubercles, in two transverse series on the terga, and in a marginal series on the pleura. The 2nd–5th terga are longitudinally carinate, the carinæ being distinct but not salient, and being neither produced nor notched posteriorly.

More than half the 3rd joint of the antennular peduncle projects beyond the antennæ.

The proximal (outer) antennal squame has both its edges serrated, and is traversed by a single oblique midrib: the distal lobe has its free margin cut into 7 teeth, of which 2 are on the inner margin.

The legs decrease slightly in stoutness, and increase in length, from the 1st to the 4th, which, in the male, is as long as the carapace and first  $2\frac{1}{2}$  abdominal somites combined and is about a third of a dactyl-length longer than the 5th pair. In the female the 4th pair are only as long as the carapace and first 2 abdominal somites combined, and are at least a dactyl-length longer than the 5th pair, which in this sex are almost perfectly chelate. In the first 3 pairs the propodite is compressed and broadened, especially in the case of the 3rd pair of the female: in the 4th and 5th pairs the propodite is long and subcylindrical, that of the 4th pair being more than three-fourths the length of the merus.

In the male the appendages of the 2nd abdominal somite are biramous, both rami being falcate-foliaceous, and those of the 3rd-5th somites are rudimentary in the adult though distinct enough in the young.

In the female the appendages of the 2nd abdominal somite are biramous, both rami being broadly foliaceous, and those of the 3rd-5th somites are biramous with the outer ramus foliaceous and the inner slender and 3-jointed.

In an egg-laden female, the carapace is 31 millim. long.

Bay of Bengal, off Madras coast, 91 fathoms: Arabian Sea, off Calicut, 100 fathoms.

Regd. No.  $\frac{4254-4250}{7}$  :  $\frac{3380-3386}{10}$ .

### 107. *Arctus rubens*, Alcock and Anderson.

*Arctus rubens*, Alcock and Anderson, Journal Asiatic Soc. Bengal, Vol. LXIII, 1894, pt. 2, p. 165.

Carapace, measured in the middle line, not much longer than the first 5 abdominal somites, its lateral margins serrated and cut into 3 lobes: it is dorsally traversed by 3 crenulate carinæ, the middle one of which is salient and is cut into two lobes by the cervical groove, the lateral ones being not very prominent except at the inner orbital angle where they end each in a strong tooth. The branchial regions outside the lateral carinæ are beset with numerous squamiform tubercles, and there are some similar tubercles on the gastric region and along the course of the branchio-cardiac grooves. The posterior border, which is separated from the rest of the carapace by a deep groove, is deeply notched in the middle line. The thoracic sternum is concave, but not deeply so, and each of its segments carries a strong median tubercle.

There is some squamiform sculpture on the abdominal terga (especially on the 6th) and pleura. The abdominal terga 2-5 are longitudinally carinate, the carinæ of the 2nd and 3rd being deeply notched posteriorly, those of the 4th and 5th being produced posteriorly to form a blunt claw-like tooth.

Less than half the 3rd joint of the antennular peduncle projects beyond the antennæ.

The proximal squame of the antennæ has both edges serrated and is dorsally traversed by *two* oblique ridges: the distal squame has its free edge cut into 7 teeth, two of which are on the inner margin.

The legs decrease considerably in stoutness in posterior succession. The 2nd pair, which are the longest, are shorter than the carapace. The 4th are shorter than the 3rd, and equal to the 5th in the male, but a little longer than the 5th in the female, in which sex the 5th are almost chelate. In neither sex are any of the propodites particularly broadened or compressed, and in the 4th pair the propodite is not much more than half the length of the merus.

The abdominal appendages of the female are as in the preceding species. In the young male the appendages of the 2nd abdominal somite are as in the preceding species, and those of the 3rd–5th are biramous with the inner ramus of 4th and 5th short.

In a female the length of the carapace in the middle line is 26 millim., that of the abdomen 42 millim.

Colour in life, light rose madder above, white below.

Gulf of Manár, off Colombo, 142 to 400 and 180 to 217 fathoms.

Regd. Nos.  $\frac{8814}{9}$  (Types of the species):  $\frac{810}{10}$ .

### Family *Palinuridae*, White.

White, Cat. British Crust., p. 30: Dana, Proc. Acad. Nat. Sci. Philad., 1852, p. 15, and U. S. Expl. Exp. Crust., pt. I., p. 519: Spence Bate, Challenger Crust. Macrura, p. 74: Stebbing, Hist. Crust., p. 195: Ortmann in Bronn's Thier Reich (Malacostraca), p. 1137.

Carapace subcylindrical (occasionally elongate-cuboidal) with the rostrum either absent or represented by a tooth: anteriorly it is soldered to the epistome on either side, posteriorly its angles are firmly held between the last thoracic epimeron and the 1st abdominal somite. Thoracic sternum broad.

Abdomen broad, the terga overlapping, the pleura behind the 1st well developed: telson truncated or quadrate, its posterior portion is, like the greater part of the caudal swimmerets, coriaceous or membranous.

The eyes may be protected by a spine above or below, or both, but are never lodged in true orbits.

Antennular peduncle elongate, with cylindrical joints, rather weak: the flagella of no great length.

Antennal peduncle 4-jointed, not dilated, the basal joint merged in the epistome: antennal flagellum long and cylindrical: no antennal scale.

The 2nd maxillæ and the 1st maxillipeds appear to take a subordinate part in manducation.

All the maxillipeds have well developed flagellate exopodites and large foliaceous epipodites: the external maxillipeds are pediform and 7-jointed though there is no independent movement between the basis and ischium.

The thoracic legs are 6-jointed, the basis and ischium being fused: none are enlarged and none are chelate, except sometimes the last pair in the female: the first four pairs carry large foliaceous epipodites.

The first abdominal somite is destitute of appendages in both sexes.

This family is represented in the depths of Indian seas by a single species of the genus *Panulirus*.

#### PANULIRUS, White.

*Panulirus*, White, 1847, Stebbing, Hist. Crust., p. 197.

Carapace subcylindrical, or elongate-cuboidal, devoid of a rostrum or rostral spine, not covering the ophthalmic and antennal somites; its postero-lateral angles are firmly held between a button on the last thoracic epimeron below, and the projecting angle of the rudimentary 1st abdominal pleuron above; its antero-lateral angles are produced to form a large tooth, which, with the post-antennal tooth below, forms a sort of imperfect orbit: the cervical groove conspicuous.

Telson squarely-truncate, its lateral borders being very slightly convergent posteriorly.

Eyes large: ophthalmic somite exposed and membranous.

Antennular flagella subequal, of no great length: the somite exposed. Antennæ well separated from one another, the flagellum extremely long.

The mandibles consist of a large convex incisor process and a small conical molar process, and carry a three-jointed palp.

The 1st maxillæ have the coxa and basis well developed, and carry a short and slender palp. The 2nd maxillæ consist of a rudimentary coxopodite, a slender and deeply cleft basipodite, a short and blunt endopodite, and a large scaphognathite. The 1st maxillipeds have a rudimentary coxopodite, a very large basipodite, a short broad and almost rudimentary endopodite, a foliaceous exopodite ending in a short stiff flagellum, and a very large and foliaceous epipodite. The 2nd maxillipeds are short, pediform and six-jointed: their exopodite, like that of the external maxillipeds, is long and ends in an articulated flagellum, and their epipodite, like that of the external maxillipeds, is large and foliaceous.

The 1st abdominal somite is destitute of appendages in both sexes: the 2nd-5th somites have appendages which are uniramous in the male and biramous in the female.



The branchial formula is as follows:—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.	Pleurobranchiæ.		
VII	(ep.)	0	0	=	ep.
VIII	1+(ep.)	1	0	=	2+ep.
IX	1+(ep.)	2	0	=	3+ep.
X	1+(ep.)	2	0	=	3+ep.
XI	1+(ep.)	2	1	=	4+ep.
XII	1+(ep.)	2	1	=	4+ep.
XIII	1+(ep.)	2	1	=	4+ep.
XIV	0	0	1	=	1
Total	6+7 ep.	11	4	=	21+7 ep.

### 108. *Panulirus angulatus*, Spence Bate.

*Panulirus angulatus*, Spence Bate, Challenger Crust. Macrura, p. 81, pl. xi., figs. 2, 3, 4 (young): Alcock and Anderson, Journ. Asiatic Soc. Bengal, Vol. LXIII., 1894, pt. 2, p. 166.

Carapace elongate-cuboidal, its sidewalls being perpendicular, half a telson-length shorter than the abdomen: its well-defined lateral margins are cut into 3 large teeth (which decrease in size in posterior succession) in front of the cervical groove, and are serrated behind it, the serrations being acute in the young, but worn and blunt in the adult: its infraorbital spine is large and has a small spine below and anterior to it and 2 or 3 behind it: on the gastric region are two anteriorly-convergent longitudinal rows of spines (young) or tubercles (adult): behind the cervical groove is a median longitudinal carina, which is strongly spinose in the young, and crenulate or merely eroded in the adult. The whole surface of the carapace behind the cervical groove is studded with miliary tubercles, which on the sidewalls are arranged in regularly radiating series.

The abdominal terga are carinated, the carina of the 6th tergum being double: in the young the carinæ are serrated, one of the spines in each carina being much enlarged, but in the adult the serrations become smooth tubercles. Each tergum, from the 2nd to the 5th, has at either pleural end an oblique patch of sharp vesiculous tubercles (young) or elevations (adult), as well as a few small tubercles on either side of the carina. The pleura, from the 2nd to the 5th, are traversed obliquely by a row of teeth (young) or blunt tubercles (adult) and end in a pair of spines (young) or teeth (adult): the 6th pleuron ends in a single spine or tooth.

The last six thoracic sterna carry a median spine (young) or tubercle (adult), and the last five have one or two spines (young) or teeth (adult) on their raised lateral margins. The 1st abdominal sternum has a transverse row of 4 spines, the 2nd–5th have each a pair of median spines, and the 6th has two transverse rows of spines, these all being very distinct in the young, but inconspicuous in the adult.

The eyes are large, and the whole of the coriaceous ophthalmic tergum is exposed. The antennular tergum, which is about as long as broad, is unarmed, and has the stridulating ridge on either side well developed in both sexes and at all ages. The antennular peduncle is more than half the length of the carapace: the basal joint is longer than the 2nd and 3rd joints combined and longer than the flagella.

The antennal peduncle is plentifully spinose in the young, but in the adult only the outer edge of the last three joints is serrated: the stridulating tubercle is well developed and is striated on its inner (clasping) surface: the antennal flagellum is more than twice as long as the body and is spinulose along the inner edge.

The external maxillipeds reach just beyond the near end of the basal joint of the antennular peduncle.

In the male the thoracic legs increase in length and decrease slightly in thickness in succession, from the 1st pair, which are about seven-eighths the length of the carapace, to the last pair, which are as long as the carapace and first 4 or  $4\frac{1}{2}$  abdominal somites combined, and all are monodactylous.

In the female they increase in length up to the 4th pair, the 5th pair, which are almost perfect chelæ, being no longer than the 4th.

In the male the vasa efferentia project from the coxæ of the 5th pair as large acutely-conical coriaceous styles.

The abdominal appendages (2nd-5th somites) of the male consist each of a single small broadly-oval plate articulated to a short protopodite; but in the female they are all biramous, each consisting of a large foliaceous outer branch, and an inner branch which is itself biramous.

In the largest specimen the carapace is 70 millim. long, the abdomen 99 millim.

From the Gulf of Manár and the Arabian Sea off the Travancore coast, 143, 224 to 284, and 719 fathoms. The largest specimens came from the least depth.

Regd. Nos.  $\frac{8795-8813}{9}$  :  $\frac{3374-3379}{10}$  :  $\frac{3387}{10}$ .

### Family *Axiidae*, Spence Bate.

Spence Bate, Challenger Crust. Macrura, p. 36: Stebbing, Hist. Crust., p. 187: Ortmann in Bronn's Thier Reich, Malacostraca, p. 1141.

Carapace somewhat compressed, rather short, not overlapping the 1st abdominal tergum, produced anteriorly into a short triangular rostrum. The last thoracic somite is movable, and the last thoracic sternum separate. The

abdominal terga hardly overlap one another: the abdominal pleura behind the 1st are well developed: the telson is broadly truncated, and the caudal swimmerets, which are broadly foliaceous, are of equal size.

Two antennular flagella of moderate length—much longer than the peduncle.

The antennal scale, when present, has the form of a spine: the antennal peduncle is five-jointed and the flagellum lash-like.

The manducant parts of all the maxillæ and maxillipeds are normally developed. The external maxillipeds are pediform and seven-jointed. The maxillipeds and first 4 pairs of thoracic legs have foliaceous epipodites.

The thoracic legs are 7-jointed, but there is little or no independent movement between the basis and ischium. The first two pairs are chelate, the 1st pair being very large and massive: the last three pairs are monodactylous.

The abdominal appendages behind the 1st pair are biramous: those of the 1st pair in the male are slender and uniramous and are slightly modified for copulation.

The gill-elements are filaments of the trichobranchiate sort, but they often are arranged on two sides of a stem, in phyllobranchiate fashion.

In the Indian species from the deep sea it is common to find orifices, corresponding with the genital orifices of the male, in adult females.

*Synopsis of the genera of Axiidæ of the Indian Benthos.*

- |     |   |        |               |
|-----|---|--------|---------------|
| I.  | The exopodite of the caudal swimmerets is not divided by a transverse suture: at the distal end of the outer border of the 2nd joint of the antennal peduncle are two spines of considerable size—an outer “scaphocerite” and an inner “stylocerite”: pleurobranchiæ are present on somites xi, xii, xiii | ... .. | ICONAXIOPSIS. |
| II. | The exopodite of the caudal swimmerets is divided near its distal end by an obliquely transverse suture: pleurobranchiæ absent:—  |        |               |
|     | 1. The “scaphocerite” and “stylocerite” of the antennal peduncle are conspicuous spines   | ... .. | CALASTACUS.   |
|     | 2. The “scaphocerite” and “stylocerite” of the antennal peduncle are minute points only visible with a lens   | ... .. | CALOCARIS.    |

CALOCARIS, Bell.

*Calocaris*, Bell, Brit. Stalk-eyed Crust., p. 231: Ortmann, Zool. Jahrb. VI, 1891, p. 50.

Carapace much shorter than the abdomen, compressed, deeply excavated in the middle line posteriorly, the cervical groove distinct. Rostrum short, triangular.

Abdominal pleura behind the 1st well developed. Telson elongate-sub-quadrilateral, as long as the caudal swimmerets which are broadly foliaceous, the exopodite divided near its distal end by an obliquely-transverse suture.

Eyestalks short, eyes without pigment or facets. Antennular flagella about as long as the carapace.

The antennal scale is represented by a minute spine ("scaphocerite") not visible without a lens: inside it is a second minute spine ("stylocerite").

Mandibles with a large incurved 3-jointed palp. The 1st maxillæ have the coxa and basis well developed and carry a 2-jointed palp of considerable size. The 2nd maxillæ consist of well-developed and deeply-cleft coxa and basis, a tapering endopodite, and a normal scaphognathite.

All the maxillipeds have well developed exopodites and foliaceous epipodites. The exopodite of the 1st maxillipeds is stout and broad and much longer than the endopodite: those of the 2nd and 3rd (external) maxillipeds are flagelliform and about as long as their endopodites. The endopodite of the 1st maxillipeds is simple, slender, weak and short: those of the 2nd and 3rd maxillipeds are strictly pediform.

Of the thoracic legs the 1st pair are much longer and vastly more massive than any of the others and end in large chelæ: the 2nd pair are slender and chelate, and the 3rd-5th pairs slender and monodactylous. The first 4 pairs of thoracic legs have large epipodites.

The first pair of abdominal appendages are slender and uniramous in both sexes, the 2nd-5th pairs are slender and biramous and have a slender styliform internal appendix.

The eggs are large.

The branchial formula is as follows:—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.	Pleurobranchiæ.	
VII	ep.	0	0	= ep.
VIII	r+ep.	r.	0	= 2r.+ep.
IX	1+ep.	2	0	= 3+ep.
X	1+ep.	2	0	= 3+ep.
XI	1+ep.	2	0	= 3+ep.
XII	1+ep.	2	0	= 3+ep.
XIII	ep.	2	0	= 2+ep.
XIV	0	0	0	= 0
Total	4+r.+7 ep.	10+r.	0	= 14+2r.+7 ep.

The branchiæ attached to somite VIII. consist each of a tapering plate one edge of which is plumed.



*Key to the species of Calocaris.*

- I. The rostrum reaches only to the end of the basal joint of the antennular peduncle: the penultimate joint of the antennal peduncle is not twice the length of the 2nd joint           ...           ...           ...           ...           ... *C. macandreae*.
- II. The rostrum reaches to the end of the antennular peduncle: the penultimate joint of the antennal peduncle is more than three times the length of the 2nd joint           ...           ...           ...           ...           ... *C. alcocki*.

109. *Calocaris macandreae*, Bell.

*Calocaris macandreae*, Bell, British Stalk-eyed Crustacea, p. 233, fig.: Kirk, Trans. New Zealand Inst. XI. 1878, p. 401: S. I. Smith, Trans. Connect. Acad. Sci. V. 1878-82, p. 55: G. O. Sars, Arch. f. Math. Naturv. IX. 1884, p. 166, pl. ii.: Lovett, Zoologist (3) IX. 1885, p. 16: Carus, Prodr. Fann. Medit. I. p. 490: Ortmann, Zool. Jahrb., Syst., VI. 1891-92, p. 50, pl. i. fig. 5: Alcock and Anderson, Journ. Asiatic Soc. Bengal, LXIII. pt. 2, 1894, p. 163: Adensamer, Denk. Ak. Wien. Math.-Nat. Cl. LXV., 1898, p. 621: Anrivillius, Bihang Svensk. Vetensk.-Akad. Handl. XXIV., iv. No. 4, 1899, p. 36.

Carapace (rostrum included) measured in the middle line, hardly as long as the first 5 abdominal somites combined, smooth, sharply carinated in the middle line, the cervical groove fine but distinct, the branchial groove indistinct.

The rostrum, which reaches the end of the basal joint of the antennal peduncle, has its salient and sharply serrated lateral borders produced backwards on to the gastric region.

Abdomen smooth: the pleura of the 1st somite subacute, the others broadly rounded, decreasing in length from the 2nd to the 5th. Telson broadly rounded off, as long as the caudal swimmerets, all with smooth edges.

Eyes large, globose, sessile, translucent. The 1st joint of the antennular peduncle has its base somewhat expanded.

The "scaphocerite" projects hardly as far as the base of the penultimate joint of the antennal peduncle and the "stylocerite" is still more minute: the penultimate joint of the peduncle is not twice as long as the 2nd joint.

The external maxillipeds reach beyond the end of the antennular peduncle; the inner border of the ischium is elegantly toothed, but that of the merus is unarmed.

In the male the large chelipeds are about two-thirds the length of the body and the hand forms nearly half their length, but in the female they are not quite so long and the proportion of the hand is a little less: they are quite smooth, except for 2 or 3 spinules on the lower border of the merus, a spinule at the far end of the upper border of the merus, 2 carinae each ending in a spine along the upper border of the palm, and a few granules on the inner surface of the palm near the finger joint: the palm is a little longer than the wrist, and the fingers are about three times as long as the palm: the fingers are compressed slender and pointed, and the cutting-edge of only the fixed finger is finely serrated.

The 2nd legs resemble the 1st in form, but are smooth and slender. In the last 3 pairs of legs the end of the propodite, near the articulation of the dactylus, is setose.

In our largest specimen the length of the carapace, measured in the middle line and including the rostrum, is 11·5 millim., that of the abdomen 20·5 millim.

Arabian Sea, 636 fathoms: Bay of Bengal, off Ceylon, 800–637 fathoms.

Regd. Nos.  $\frac{9314}{9}$ :  $\frac{769}{10}$ .

### 110. *Calocaris alcocki*, McArdle.

*Calocaris alcocki*, McArdle, Ann. Mag. Nat. Hist., Nov. 1900, p. 476.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE L, FIG. 4.

This species can be distinguished from *C. macandreae* by the following differences:

The integument is polished. The carapace (rostrum included), measured in the middle line, is a little longer than the first 5 abdominal somites and is bluntly carinated in the middle line: the branchial grooves are as distinct as the cervical groove.

The rostrum, which reaches to the end of the antennular peduncle, is upcurved and dorsally grooved; on either lateral border, near the middle, are 1 or 2 spines, and on each of the epigastric continuations of the lateral borders is a single spine.

The eyes which are large and sessile are obliquely flattened.

The "scaphocerite" of the antennal peduncle is as small as it is in *C. macandreae*, not overlapping the base of the penultimate joint, but the "stylocerite" is longer and does overlap the base of that joint: the penultimate joint of the peduncle is more than three times as long as the 2nd joint.

The merus of the external maxillipeds has a subterminal spine on its inner border.

In the female the large chelipeds are as long as the body without the telson, and the hand is as long as the combined carpus and ischium: the carpus is two-thirds the length of the palm, and the palm is as long as the fingers: there is a terminal spine on the lower border of the ischium and on the upper border of the merus and palm: the cutting edge of the fixed finger is finely crenulate at its proximal end, and the dactylus has an enlarged tooth near its base.

In the female the propodite and endopodite of the 2nd pair of abdominal appendages are long and rigid, and articulated to the tip of the endopodite is a large boot-shaped plate, its toe pointing backwards and its heel armed with a spine.

The length of the carapace and rostrum, measured in the middle line, is 21 millim., of the abdomen 33 millim.

From the Bay of Bengal, off Ceylon, 542 fathoms.

Regd. No.  $\frac{3813}{10}$  (Type of the species).

#### Subgenus CALASTACUS, FAXON.

*Calastacus*, Faxon, Bull. Mus. Comp. Zool. XXIV. 1893, p. 194, and Mem. Mus. Comp. Zool. XVIII. 1895, p. 105.

*Calastacus* agrees with *Calocaris* in every respect except that the "scaphocerite" and "stylocerite" of the antennal peduncle are conspicuous spines, as they are in *Iconaxiopsis*.

According to Faxon, the somite (VIII) which carries the 2nd maxillipeds has neither podobranch nor arthrobranch, but in the two Indian species which, on account of their long "scaphocerite" and "stylocerite" must be assigned to *Calastacus* rather than to *Calocaris*, this somite has, in addition to an epipodite, two tapering plates with one edge distantly and minutely plumose, which undoubtedly are rudimentary podobranch and arthrobranch.

#### Key to the Indian species of *Calastacus*.

- |     |  |     |     |     |     |     |                           |
|-----|--|-----|-----|-----|-----|-----|---------------------------|
| I.  | Some lank silky setæ on the carapace and abdomen: on the gastric region, behind the spines at the base of the rostrum, is a horse-shoe of spines | ... | ... | ... | ... | ... | <i>C. felix.</i>          |
| II. | No long setæ on the carapace or abdomen: no spines behind those at the base of the rostrum   | ... | ... | ... | ... | ... | <i>C. investigatoris.</i> |

#### 111. *Calocaris (Calastacus) investigatoris*, Anderson.

*Calastacus investigatoris*, Anderson, Journ. Asiatic Soc. Bengal, LXV. pt. 2, 1896, p. 97.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XXV. FIG. 1.

Carapace (rostrum included), measured in the middle line, as long as the first  $5\frac{1}{2}$  abdominal somites, studded with sharpish vesiculous granules, finely carinated in the middle line, the carina terminating in a vesiculous tubercle and having a similar tubercle in the middle of its gastric course: the cervical and branchial grooves very conspicuous.

The rostrum does not quite reach the end of the 2nd joint of the antennular peduncle: its sides are prolonged on to the gastric region as two sharp ridges, each of which carries two spines.

The abdominal pleura behind the subacute 1st, are broadly rounded and have the surface somewhat corrugated: they decrease in length from the 2nd to the 5th. Telson broadly rounded off, as long as the caudal swimmerets,

which are not serrated though there are 2 or 3 spines on the outer border of the exopodite.

The eyes form a colourless flange to the end of the short fixed eyestalks.

In the antennular peduncle the basal joint is the longest and has its proximal end expanded and armed externally with 2 spinules.

In the antennal peduncle the scaphocerite, which is shorter than the stylocerite, hardly reaches a fourth of the way along the penultimate joint.

The external maxillipeds reach slightly beyond the end of the antennular peduncle; the ischium is elegantly dentated and the merus is spinose along the inner border.

In the female the large chelipeds are just over half the total length of the body, much more than two-fifths of their length being contributed by the hand: the lower border of the ischium and merus and the upper border of the palm and of the distal half of the merus are spinose; a salient serrulate ridge runs along the lower border of the outer surface of the palm and fixed finger, and there are some scattered miliary granules on both surfaces of the palm: the palm is a little longer than the carpus and a little shorter than the fingers, the fingers are slender and sharp and do not meet at base, the cutting-edge of the fixed finger is finely serrulate: there are a few setæ on the fingers and palm.

The 2nd pair of chelipeds are a little stouter and shorter than the three last pairs of legs: the latter have a long propodite and a slender acute dactylus.

Colour in life; abdomen light brown, carapace very pale pink fading to slate-colour on the sides.

Length of carapace and rostrum measured in the middle line 22 millim., of abdomen 32.5 millim.

From the Arabian Sea, off the coast of Sind, 947 fathoms.

Regd. Nos.  $\frac{49-50}{10}$  (Types of the species).

## 112. *Colocaris (Calastacus) felix*, Alcock and Anderson.

*Calastacus felix*, Alcock and Anderson, Ann. Mag. Nat. Hist., April 1899, p. 287.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLII. FIG. 3.

Carapace (rostrum included), measured in the middle line, as long as the first 6 abdominal somites; its surface is pitted, and lank antrorse setæ, which are very distinct on the gastric and cardiac regions, spring from the pits; the cervical groove is distinct, but the branchial grooves are indistinct.

The rostrum reaches to the end of the 2nd joint of the antennular peduncle; in addition to the 2 spines on each of its lateral prolongations on to the gastric region, there are 2 large spines on each of its edges near the tip.



The median carina of the carapace is very distinct at the posterior border and also on the gastric region. On the gastric region is a series of antrorse spines arranged in the form of a long narrow horseshoe with the convexity forwards.

There are some very long and lank retrorse setæ on the abdomen: the abdominal terga are subcarinate, the pleura behind the 1st are broad but somewhat angular, the edges of the telson and the outer edge of the outer caudal swimmeret are serrated, as also is the edge of the transverse suture.

The eyes show as an irregular speck of pigment on the outer side of the tip of the short fixed eyestalks. There are no spinules on the outer edge of the expanded basal portion of the 1st joint of the antennular peduncle. The scaphocerite and stylocerite of the antennal peduncle are similar to those of *C. investigatoris*.

The large chelipeds of the female are more than half the length of the body, and all that part of them which lies beyond the carapace is rather thickly setose: the lower border of the ischium has a single spine, the lower border of the merus 2 spines, and the upper border of the merus a single terminal one; both borders of the carpus and palm are serrulate or serrate: the fingers are as long as the palm, and the palm is a good deal longer than the wrist; the fixed finger, the tip of which is truncated, has near its proximal end 2 or 3 small teeth followed by a much enlarged one.

In the 3rd and 4th pairs of legs the long propodite and short pointed dactylus have, in addition to some long lank setæ, some squamiform rows of short stiff setæ. In the 5th pair of legs the last two joints have only a few long setæ, and the dactylus is subspathulate.

Length of carapace and rostrum, measured in the middle line, 18 millim., of abdomen 24 millim.

Arabian Sea, off Cape Comorin 430 fathoms.

Regd. No.  $\frac{2174}{10}$  (Type of the species).

#### ICONAXIOPSIS n. gen.

If Spence Bate's figure of the 2nd maxillipeds of *Iconaxius acutifrons* is correct, and if his branchial formula of the same species is to be relied on, the Indian species that have hitherto been assigned to this genus must be separated as a distinct genus agreeing with *Iconaxius* in all respects except the following:—

(1) the 2nd maxillipeds have the exopodite much longer than the endopodite, and in addition to the foliaceous epipodite, they carry a podobranch and an arthrobranch, each of which consists of a tapering plate one edge of which is minutely and distantly plumose:

(2) there are well developed pleurobranchiæ to the somites XI. XII. XIII.

Carapace much shorter than the abdomen, somewhat compressed, deeply excavated in the middle line posteriorly, without any grooves or sutures except

the cervical, which is indistinct: rostrum short, triangular. The abdominal terga behind the 1st are of approximately the same length, and the abdominal pleura behind the 1st are well developed: the telson is square cut and the exopodite of the tail-fan is not divided by any suture, both the caudal swimmerets being broad.

Eyestalks very short: eyes very pale or quite undistinguishable. Two antennular flagella, which are about as long as the carapace.

There is a spiniform antennal scale of good length, and inside it the outer angle of the 2nd joint of the antennal peduncle forms an equally conspicuous spine.

The 2nd maxillæ consist of well-developed and deeply-cleft coxopodite and basipodite, a tapering endopodite and a normal scaphognathite, exactly as in *Nephrops*, &c.

All the maxillipeds are furnished with exopodites and foliaceous epipodites: in the 1st pair the exopodite is short and foliaceous, in the 2nd pair it is flagelliform and longer than the endopodite, and in the 3rd pair it is slender and tapering but has no terminal flagellum: in the 1st pair the endopodite is foliaceous, in the 2nd and 3rd pair it is strictly pediform, being 7-jointed in the 3rd pair. The first 4 pairs of thoracic legs are furnished with large epipodites.

The thoracic legs of the 1st pair which are chelate, are very massive, and are a little unequal: the hand, which forms the greater part of their bulk, is compressed both as to the palm and as to the fingers, the fingers being hardly as long as the palm: the carpus is a short, deep, compressed joint.

The 2nd-5th legs are slender and are much shorter than the 1st: the 2nd pair are minutely but perfectly chelate, the others end in a short dactylus.

In the female the abdominal somites, from the 2nd to the 5th, bear biramous narrowly-foliaceous appendages; but in the male the appendages of the 1st somite are uniramous and slender organs of copulation: in the female they are slender and uniramous.

The eggs are few and of very large size.

The branchial formula is as follows:—

Somites and Appendages.	Podobranchiæ.	Arthrobranchiæ.	Pleurobranchiæ.	
VII	ep.	0	0	= ep.
VIII	r. + ep.	r.	0	= 2 r. + ep.
IX	1 + ep.	2	0	= 3 + ep.
X	1 + ep.	2	0	= 3 + ep.
XI	1 + ep.	2	1	= 4 + ep.
XII	1 + ep.	2	1	= 4 + ep.
XIII	ep.	2	1	= 3 + ep.
XIV	0	0	0	= 0
Total	4 + r. + 7 ep.	10 + r.	3	= 17 + 2 r. + 7 ep.

The rudimentary branchiæ of somite VIII. consist each of a tapering plate one edge of which is minutely and distantly plumose.

*Key to the species of the genus Iconaxiopsis.*

- I. The rostrum reaches the end of the 2nd joint of the antennular peduncle: in one of the hands the fixed finger has, at the basal end of its cutting-edge, two enlarged teeth separated by a notch ... *I. laccadivensis.*
- II. The rostrum hardly reaches the end of the basal joint of the antennular peduncle: in neither hand are there any conspicuously enlarged teeth on the fixed finger ... .. *I. andamanensis.*

113. *Iconaxiopsis laccadivensis*, n. sp.

*Eiconaxius kermadeci* var. *laccadivensis*, Alcock and Anderson, Journ. As. Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 162.

The carapace (rostrum included) measured in the middle line, is hardly as long as the first 5 abdominal somites combined, and is smooth, compressed, and dorsally tumid. The rostrum, which is triangular and depressed and has its edges microscopically serrulate, reaches to the end of the second joint of the antennular peduncle.

Abdomen smooth: pleura 2-4 bluntly pointed: telson equal in length to the oval caudal swimmerets, itself truncate oval, the edges of both telson and swimmerets finely serrated.

Eyes subsessile, very faintly pigmented. Upper antennular flagellum about as long as the carapace without the rostrum.

The spiniform antennal scale is not so long as the spiniform prolongation of the 2nd joint of the antennal peduncle ("stylocerite"), the latter spine reaching nearly to the end of the peduncle: both spines are smooth.

The external maxillipeds reach beyond the antennal peduncle.

The massive chelipeds of the 1st pair are about as long as the entire abdomen, more than half their bulk being hand: except for microscopic serration of the inner border of the ischium and merus, a minute denticle on the lower border of the carpus, a small tooth at the far end of the upper border of the palm, and for a ridge along the lower border of the palm and fixed finger, they are smooth: the fingers and lower border of the palm are slightly setose. In one hand the cutting edge of the fixed finger carries, near the finger cleft, two enlarged teeth separated by a characteristic notch.

The thoracic legs 2-5 are slender, smooth, and about as long as the carapace: all have the propodite long: the 2nd are minutely chelate, the 3rd-5th end in a very short subspathulate dactylus.

The type specimens, which in life were of a creamy colour, were found harbouring in the bracts of the curious Alcyonarian zoophyte *Calypterinus allmani*.

In an egg-laden female the carapace (rostrum included) is  $6\frac{1}{2}$  millim. long, the abdomen  $11\frac{1}{2}$  millim. The eggs are oval and nearly 2 millim. in major diameter.

Arabian Sea, near the Laccadives and off the Travancore coast, 360, 430, and 705 fathoms.

Regd. Nos.  $\frac{8858-8859}{9}$  (Types of the species) :  $\frac{2015}{10}$  :  $\frac{2175}{10}$ .

114. *Iconaxiopsis andamanensis*, n. sp. Plate II. fig. 1.

Closely resembles *I. laccadivensis*, from which it can be recognized by the following characters, besides its larger size:—

The carapace (rostrum included) measured in the middle line, is little longer than the first 4 abdominal somites combined.

The rostrum has its edges quite smooth and does not reach to the end of the basal joint of the antennular peduncle.

The eyes are unrecognizable, having no pigment.

The massive 1st pair of chelipeds are a little longer than the abdomen, and the fingers and lower border of the palm are more setose than in *I. laccadivensis*: except for a minute denticle at the far end of the inner border of the ischium and merus and on the lower border of the carpus and for a ridge along the lower border of the palm and fixed finger, they are smooth. In one hand both edges of the finger-cleft of the propodite are smooth, and in the opposite hand the cutting edge of the dactylus is notched to correspond with a slightly enlarged tooth on the fixed finger.

In the thoracic legs 3-5 the dactylus is subspathulate and has its edge elegantly serrated, the teeth being dark brown.

In the largest male the carapace (rostrum included) is 10 millim. long, the abdomen  $19\frac{1}{2}$  millim. An egg-laden female is a little smaller. The eggs are about 2 millim. in major diameter.

Bay of Bengal, off the west coast of the Andamans, 238-290 fathoms.

Regd. No.  $\frac{9936}{6}$  (Types of the species).



Family *Callianassidæ*, Bate.

Spence Bate, Challenger Crust. Macrura, p. 27: Stebbing, Hist. Crust., p. 183: Ortmann in Bronn's Thier Reich (Malacostraca), p. 1142.

Carapace short, not overlapping the 1st abdominal tergum; rostrum short, triangular, or rudimentary. The last thoracic somite is movable and the last thoracic sternum separate. The abdominal terga, which are more or less unequal in size, hardly overlap one another, and the pleura are rudimentary or absent. [The telson is usually subquadrate and the caudal swimmerets usually foliaceous].

Two antennular flagella of no great length. The antennal peduncle is five-jointed and the flagellum lashlike: no antennal scale.

The external maxillipeds are either pediform or sub-operculiform.

The thoracic legs are 7-jointed, but there is no independent movement between the basis and ischium. The 1st or 1st and 2nd pairs may be chelate, or the 1st pair may be subchelate and the 2nd pair may be monodactylous: the 3rd and 4th pairs are monodactylous, but the 5th pair may be subchelate or even imperfectly chelate.

[In all the Indian deep-sea species the 1st pair of abdominal appendages are slender uniramous filaments, the gill-elements are phyllobranchiæ, epipodites are absent behind the 1st maxillipeds, and podobranchiæ and pleurobranchiæ are absent].

*Synopsis of the genera of Callianassidæ of the Indian Benthos.*

- |     |   |     |     |     |              |
|-----|---|-----|-----|-----|--------------|
| I.  | Carapace less than half the length of the abdomen, rostrum small or rudimentary: external maxillipeds broadly pediform, without an exopodite: |     |     |     |              |
|     | first 2 pairs of thoracic legs chelate  | ... | ... | ... | CALLIANASSA. |
| II. | Carapace more than half the length of the abdomen, rostrum of fair size:  |     |     |     |              |
|     | external maxillipeds slenderly pediform, with a slender exopodite: first 2 pairs of thoracic legs non-chelate                                 | ... | ... | ... | GEBICULA.    |

## CALLIANASSA, Leach.

*Callianassa*, Leach, Edinburgh Encyclopædia, Art. Crustaceology VII., p. 400 (*apud* Stebbing), and Malac. Pod. Brit.: Milne Edwards, Hist. Nat. Crust. II. 307: Heller, Crust. Südl. Europ., p. 201: A. Milne Edwards, Nouv. Archiv. du Mus. VI. 1870, p. 75: Spence Bate, Challenger Crust. Macrura, p. 28: Stebbing, South African Crust., p. 38.

Carapace very short, less than half the length of the abdomen, the posterior border concave, the *linæ thalassinicæ* (or longitudinal sutures that mark the fusion between the median and lateral elements of the carapace) very distinct. Rostrum short, triangular, or rudimentary.

Abdomen long, the terga, which are very unequal in length and breadth, not overlapping one another; the pleura small, or rudimentary, or absent. In

all the Indian species the telson is subquadrangular and the caudal swimmerets are broadly foliaceous.

Eyestalks lamellar, the eyes, when present, lie on the dorsal surface.

The antennular flagella, which are two in number, are of no great length. No antennal scale.

The external maxillipeds are broadly pediform or actually opercular: they have no exopodite or epipodite. The 2nd maxillipeds have a flagelliform exopodite and may have the rudiment of an epipodite. The 1st maxillipeds have a foliaceous exopodite and epipodite. The other mouth-parts are normal, the 1st maxillæ having a two-jointed palp of good size, and the mandibles a large incurved three-jointed palp. None of the thoracic legs have epipodites.

The 1st pair of thoracic legs, which are chelate, are longer and much larger than any of the others: one of the pair owing to the size of its wrist and hand is vastly more massive than its fellow, these two joints being deep and compressed. The 2nd pair of legs, which are subequal, are chelate, ending in a broad lamellar hand. The 3rd pair of legs have an oval compressed propodite and a small dactylus. The 5th pair are more or less distinctly subchelate.

The branchiæ are phyllobranchiæ and are arthrobranchiæ: they are 10 in number on each side, a pair being attached to the 5 somites IX–XIII.

*Key to the species of Callianassa of the Indian Oligobenthos.*

- I. Carapace nearly half the length of the abdomen: eyes absent, though the eyestalks are well-developed ... .. *C. cæcigena*.  
 II. Carapace not quite a third the length of the abdomen: eyes present ... *C. lignicola*.

115. *Callianassa cæcigena*, Alcock and Anderson.

*Callianassa cæcigena*, Alcock and Anderson, Journ. Asiatic Soc. Bengal, LXIII. pt. 2, 1894, p. 163.  
 ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XXVI. FIG. 2.

Belongs to M. Milne-Edwards' first section of the genus (A. Milne-Edwards, Nouv. Archiv. du Mus., VI., 1870, p. 75), in which it stands alone in having no trace of corneæ, although the eyestalks are well developed and of the usual form. It is otherwise close to *C. gigas*, Dana.

The carapace, which is a little less than half the length of the abdomen, is of the typical form, and ends in an acute triangular rostrum that reaches to the end of the eyestalks—these not reaching to the end of the basal joint of the antennular peduncle. The middle of the three segments into which the carapace is longitudinally divided is gently earinated, the carina culminating, near the posterior border, in a large strong upstanding tooth. Of the abdominal terga no two are at all alike either in size or shape. The first, which is the narrowest and by far the shortest and has all its angles cockled upwards, is not two-fifths

the length of the second which is considerably the longest: the second, which is half the length of the carapace (rostrum included), has its postero-lateral angles spiniform: the third to the sixth inclusive all have on either side, near the antero-lateral angle, a sharp recurrent declivous spine (rudimentary pleura): the third, fourth and fifth are broad, the sixth is long and narrow: the telson which is as long as the sixth tergum, and about as long as the caudal swimmerets, has its sides convergent and its tip broad and blunt; the caudal swimmerets are broadly foliaceous, the outer being the larger.

The eyestalks are of the usual petaloid shape, and, as already mentioned, are devoid of any trace of a cornea.

The antennular peduncle, of which the middle joint is the shortest, is about two-thirds the length of the upper antennular flagellum; this, which is stouter and slightly longer than the lower flagellum, is about half the length of the carapace.

The external maxillipeds are compressed and broadly pediform—the ischium having its inner basal angle produced to form an operculum: the dactylus is a large, almost circular, plate, thickly beset with hairs. Of the first pair of thoracic legs the right is many times larger than the left, its length, more than half of which is hand, being equal to that of the carapace and first four abdominal somites combined: the ischium is spinate along its lower edge: the merus has a single claw-like spine at its proximal end: the carpus is considerably less than half the length of the palm of the hand, and has two small spines at its much produced lower angle: the hand is longer and broader than the carapace, the palm is carinated along both the upper and the lower edge, the lower edge being also finely serrated: the dactylus, which is longer than the fixed finger, is equal in length to the palm, is broadly flanged, both outside and inside, above, and has, on its cutting surface, at the proximal end, two short rows of coarse crenulations, the outer of which is continued into a sharp-edged ridge: the fixed finger has at its base, in the finger-cleft, a strong sharp tooth.

The smaller cheliped of the first pair resembles its fellow as to the ischium and merus; but the carpus is more than  $\frac{3}{4}$  the length, and the fingers nearly twice the length, of the palm: the fingers, besides being relatively much longer, are also much straighter, and, except for a single large tooth at the base of the fixed finger, are unarmed.

The 2nd–5th pairs of legs, which have stoutish compressed joints, are of about equal length. Those of the 2nd pair are about as long as the carapace and end in a short broad compressed hand, the edges and outer surface of which are setose, as also are the inner border of the merus and the upper and distal borders of the carpus. In the 3rd–5th pairs the small dactylus is much hidden in setæ, especially in the case of the imperfectly-subchelate 5th pair, in which



the dactylus is particularly small and the setæ of the propodite particularly abundant.

The first pair of abdominal appendages (in the female) are short and forked, the outer fork being filiform, the inner being very short, truncate, and ending in a long slender tuft of hairs. The second to fifth pairs inclusive are very broadly lamellar, the exopodites and endopodites being nearly equal in size: in every case the inner edge of the endopodite carries, near the middle, a small styliform appendage.

Colours in life, ivory white with some scattered yellow-ochre flecks.

The length of the carapace in the middle line (rostrum included) is 21 millim., of the abdomen 44 millim.

From the Bay of Bengal, off Ceylon, 200–350 fathoms.

Regd. No.  $\frac{9321}{9}$  (Type of the species).

#### 116. *Callianassa lignicola*, Alcock and Anderson.

*Callianassa lignicola*, Alcock and Anderson, Ann. Mag. Nat. Hist., April 1899, p. 288.  
ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLII, FIG. 2.

Carapace a little less than a third the length of the abdomen, the middle of the segments into which it is longitudinally divided non-carinate: rostrum minute, just projecting between the basis of the eyestalks.

No two abdominal terga are alike in length and breadth, but they do not differ much otherwise; none of them have any lateral (pleural) spines; the 2nd is by far the longest. The telson, which is quadrangular with the sides convergent, is much shorter than the 6th tergum and shorter than the caudal-swimmerets, which are broadly foliaceous.

Eyes small, but very black and distinct. The antennular peduncle, of which the 3rd joint is longer than the first two combined, is longer than the antennular flagella, these being less than a third the length of the carapace.

External maxillipeds distinctly opercular, the ischium and merus being broad and quadrangular.

In the large cheliped of the 1st pair the hand forms more than half the total length: the lower border of the ischium is serrated, and there is a spine at the proximal end of the merus, but the other joints are smooth: the carpus is as broad as, and a little more than half the length of the palm: the hand is as long, but not as broad, as the carapace: the dactylus is longer than the fixed finger, but shorter than the palm; the fixed finger has a single large tooth on its cutting edge.

In the smaller of the large chelipeds of the 1st pair the merus wants the proximal spine, and the wrist is about as long as the palm.



In the female the 1st pair of abdominal appendages are very fine uniramous filaments, the 2nd pair are almost as slender but are biramous, and the 3rd-5th pairs are foliaceous and biramous with a small internal appendix.

In an egg-laden female the carapace is 3 millim. long, measured in the middle line, and the abdomen 9.5 millim. The eggs are large.

Andaman Sea 185 and 244 fathoms. One specimen was extracted from a water-logged mangrove twig dredged from the bottom.

Regd. No.  $\frac{2173}{10}$  (Type of the species):  $\frac{504}{7}$ .

#### GEBICULA n. gen.

Differs from *Gebia* in having the 1st pair of thoracic legs simple and the last pair almost perfectly chelate: the telson is much shorter than the caudal swimmerets.

Carapace shorter than the abdomen, the posterior border very concave, the *lineæ thalassinicæ* and cervical suture very distinct. Rostrum broadly triangular.

The abdominal terga, which are very unequal in length and breadth, do not overlap one another: the pleura are rudimentary: the telson is short and quadrate, the caudal swimmerets broadly foliaceous, the exopodite being without a diagonal suture.

Eyestalks short, almost hidden beneath the rostrum. The antennular flagella, which are two in number, are short. No antennal scale, the antennal flagellum as long as the body.

The 2nd and 3rd maxillipeds are strictly pediform: both have slender exopodites but no epipodites. There are no epipodites on any of the thoracic appendages.

The 1st pair of thoracic legs, which are equal and symmetrical, are longer and much stouter than any of the others: they must be described as strictly monodactylous, for though the dactylus can be flexed at right angles with the propodite, yet when so flexed it stands quite clear of the propodite and its tip does not impinge against anything. The 2nd-4th pairs of legs are monodactylous, but the 5th pair are almost perfect chelæ.

The abdominal appendages of the 1st somite are slender and uniramous: those of the 2nd-5th somites are biramous, with the exopodite long lamellar and setose, and the endopodite short and styliform.

The gills are small arthrobranchiæ, arranged in pairs on somites IX to XIII as in *Callianassa*, and the gill-elements are disposed in two rows one on either side of a central stem, like phyllobranchiæ.

The single species at present known belongs to the Andaman oligobenthos.

117. *Gebicula exigua*, n. sp. Plate II. fig. 4.

Carapace (rostrum included), measured in the middle line, hardly as long as the first 5 abdominal somites: it is cut up by the *linea thalassinica* and cervical suture into six completely isolated areas, namely, a gastric and cardiaco-intestinal in the middle line, and a hepatic and branchial on either side.

The rostrum, which is broadly triangular, reaches to the end of the 4th joint of the antennal peduncle: it has a large spine on either side of its base, behind which spine a line of tiny spinules runs towards the cervical suture. Similar tiny spinules bound the lateral portion of the cervical suture.

The anterior border of the carapace, between the basal spine of the rostrum and the cervical suture, is armed with 3 or 4 spines, and there is a (hepatic) spine where the cervical suture cuts the *linea thalassinica*.

The 1st abdominal tergum is the shortest and narrowest, and the 6th is the longest and next narrowest: the 2nd, 3rd and 4th do not differ much in breadth, but the 2nd is as long as the 3rd and 4th combined: the 3rd, 4th and 5th are of about equal length. The exopodite of the caudal swimmeret is larger and longer than the endopodite, which, again, is longer than the subquadrate telson.

The eyes are pale brown. The antennular and antennal peduncles are of nearly equal length, but the former is far the more slender: the antennular flagella are hardly longer than their peduncle and are not nearly half the length of the carapace: the outer is very much thicker than the inner. The 1st, 3rd and 4th joints of the antennal peduncle have each a spine on the lower border.

The slender external maxillipeds reach to the end of the antennal peduncle.

The 1st pair of thoracic legs are as long as the combined carapace and first 2 abdominal terga: all their joints, except the basis and dactylus, are spinose: the propodite, which is subcylindrical, is about twice as long as the carpus, and about two-thirds as long as the merus: the dactylus, which is slender and pointed, is about three-quarters as long as the propodite against which it can be flexed at right angles, though in this position only its proximal end is in contact with the propodite.

The 2nd and 3rd pair of legs are a little longer than the carapace: in both, there are some spines along the posterior border of the merus and a spine at the far end of the anterior border of the same joint, and 1 or 2 spines on both borders of the carpus.

The 4th and 5th pair of legs are shorter than the carapace, and decidedly more slender than the 2nd and 3rd pair: the 4th has 2 or 3 spinules on the posterior border of the merus, the 5th ends in a little claw-like dactylus which is turned forwards and forms with the produced opposite angle of the propodite an almost perfect chela.

The appendages of the 1st abdominal somite are very short and slender filaments: those of the 2nd-5th somites are biramous with the exopodite long lamellar and setose and the endopodite short and styliform.

Length of carapace and rostrum 6 millim., of abdomen 9 millim.

From the Andaman Sea 265 fathoms.

Regd. No.  $\frac{3113}{9}$  (Types of the species).

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## PART II. CRUSTACEA ANOMALA OR ANOMURA.

### INTRODUCTION.

The *Anomala* included in this Memoir are the *Anomala* of DeHaan and of Boas, which differ from the *Anomala* or *Anomura* of other monographers as follows:—

From the *Anomura* of Milne Edwards in the exclusion of the *Dromidæ*, *Homolidæ*, *Raninidæ*, and *Pactolus*, and in the inclusion of the *Galatheidæ*.

From the *Anomoura* of Dana in the exclusion of the *Anomoura superiora*.

From the *Anomura* of Henderson in the exclusion of the *Dromidea* and *Raninidea*.

And they correspond with the *Anomoura Schizosomi* of Stimpson.

With Boas, I regard the *Raninidea* as true Crabs allied to the Oxystomes, and the *Dromidea* as a section of the *Brachyura*; and I follow Bouvier in the opinion that the immediate affinities of the *Dromidea* are, not with the *Anomala*, but with the Macrurous *Nephropsidæ* (= *Homaridæ*).

The *Anomala* here described were dredged by the Royal Indian Marine Survey Ship "Investigator," in deep water, and within the geographical limits already mentioned.

They number 52 species, of which only 12 can be identified with species found in other regions, several of these being forms that are well known to have a wide range in abyssal depths.

Only 8 species were dredged in the great deep, namely:—

<i>Parapagurus pilosimanus</i> , A. M. Edw.	(705-) 1997	fathoms.
<i>Munidopsis edwardsi</i> , W.-M.	1300-1310	,,
„ <i>granosa</i> , n. sp.	1520	,,
„ <i>ciliata</i> , W.-M.	1310	,,
„ <i>subsquamosa</i> , Hend. var.	1803	,,
„ <i>arietina</i> , Alc. & And.	1520	,,
„ <i>centrina</i> , Alc. & And.	1520	,,
<i>Galacantha rostrata</i> , A. M. Edw.	1022-1520	,,

There can be no doubt that these all came from the bottom.

Most of the new species discovered by the "Investigator" have been figured in the *Illustrations of the Zoology of the Investigator* for the years 1895-1901, and have been described in the following papers:—



J. WOOD-MASON, *Ann. Mag. Nat. Hist.*, Feb., 1891, pp. 199–202.

A. ALCOCK, *Ann. Mag. Nat. Hist.*, March, 1894, pp. 242–245; April, 1894, pp. 321–334; and *Journal Asiatic Soc. Bengal*, Vol. LXVIII. pt. 2, 1899, pp. 111–117, pl. i.

A. ALCOCK and A. R. S. ANDERSON, *Journal Asiatic Soc. Bengal*, Vol. LXIII. pt. 2, 1894, pp. 166–175, and *Ann. Mag. Nat. Hist.*, January, 1899, pp. 14–27.

A. R. S. ANDERSON, *Journ. Asiatic Soc. Bengal*, Vol. LXV. pt. 2, 1896, pp. 99–101.

J. R. HENDERSON, *Journ. Asiatic Soc. Bengal*, Vol. LXV. pt. 2, 1896, pp. 516–536.

The following is a list of the species.

LIST OF THE INDIAN DEEP-SEA CRUSTACEA ANOMALA IN THE INDIAN MUSEUM.

[The references for the plates and figures are to the *Illustrations of the Zoology of the Investigator* for 1895–1899].

The species marked with an asterisk are those that are known to occur outside Indian limits.

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19.	,, <i>tricarinata</i> , Alc.	...	...	246	...	XII	...	1
20.	<i>Munidopsis hemingi</i> , Alc. & Anders.	...	...	251	...	LV	...	4
21.	,, <i>dasypus</i> , Alc. & Anders.	...	...	252	...	XIII	...	9
22.	,, <i>unguifera</i> , Alc. & Anders.	...	...	253	...	XI	...	4
23.	,, <i>scobina</i> , Alc.	...	...	254	...	XIII	...	1
24.	,, <i>iridis</i> , Alc. & Anders.	...	...	255	...	XLIV	...	1
25.	,, <i>stylirostris</i> , W.-M.	...	...	256	...	XIII	...	6
26.	,, <i>wardeni</i> , Anders.	...	...	257	...	LV	...	1
27.	,, <i>goodridgii</i> , Alc. & And.	...	...	258	...	XLIV	...	2
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41.	,, ,, <i>ceratophthalmus</i> , n. sp.	...	...	271				
42.	,, ( <i>Elasmonotus</i> ) <i>cylindrophthalmus</i> , Alc.	...	...	272	...	XIII	...	4
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48.	,, <i>investigatoris</i> , Alc. & And.	...	...	281	...	XLV	...	1
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*51.	,, <i>australis</i> , Hndrsn. var. <i>indicus</i>	...	...	284				
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## Class CRUSTACEA: Order DECAPODA.

## Suborder ANOMALA, DeHaan.

DeHaan, Fauna Japonica, Crust., p. 195: Boas, Vid. Selsk. Skr. 6 Række, naturvid. og math. Afd. I. 2. 1880, pp. 158, 189: Stebbing, Hist. Crust., p. 149.

Although there are some *Anomala*, such as *Pylocheles*, that can hardly be separated from the Thalassinoid *Macrura*, and others, such as *Ptychogaster*, that closely approach the Astacoid *Macrura*; and although they are some *Brachyura*, such as *Homola*, whose affinities at first sight seem to incline more towards the

*Anomala* than to the Crabs; yet I am convinced that the ANOMALA, as defined by DeHaan, are a very natural—though they certainly cannot be a “monophyletic” —group; and I think it is convenient to recognize them as a primary division of the Decapod Crustacea.

The *Anomala* may be recognized by the following characters:—

The abdomen in its entirety is less well developed than the cephalothorax: though in a few exceptional forms it is elongate and extended in a straight line, it is as a rule flexed on itself, or flexed against the thoracic sternum, or is coiled in a spiral, in which last case it is more or less soft and asymmetrical.

The carapace is traversed on either side, in a longitudinal or obliquely-longitudinal direction, by a distinct suture—the *linea anomurica*—which marks off more or less of the sidewall of the carapace from the dorsal and dorso-lateral region.

The last thoracic somite is independent, the last thoracic sternum, when it is not atrophied, being separate and freely movable.

In correspondence with the reduction of the last thoracic somite, the last pair of thoracic legs are always reduced in length.

The 1st pair of legs are well developed and chelate, the 2nd and 3rd pairs are well developed and monodactylous; either the 4th and 5th pairs are both much reduced in size, or if the 4th pair are as well developed as the 2nd and 3rd then the 5th pair are slender, weak, and folded.

The genital ducts never open upon the sternum.

In addition, the following points are characteristic of the suborder, though they are not constant:—

The rostrum is often ill-developed and often fails to cover the ophthalmic somite completely.

The abdominal pleura when present (as often they are *not*) are almost never bent at a strong angle with their terga, but are extended laterally in the same plane with them.

There may sometimes be an orbital notch, but the eyes are never concealed in orbits.

The antennular peduncle is generally weak and flexed and longer than the flagella.

The antennal scale, when present, is an “acicle,” and is never foliaceous.

The external maxillipeds are commonly pediform.

Epipodites are very much more often absent than present on the thoracic legs and 2nd maxillipeds.

The abdominal appendages are weak, and have a tendency to become rudimentary or to disappear on one or both sides.

The branchiæ are commonly 14 on either side, and are commonly phyllobranchiæ.

DeHaan divided the *Anomala* into 5 families, Boas divides them into 3 sections, two of which are represented in the depths of the sea, while the third includes only burrowing littoral forms.

*Key to the family-groups of Anomala of the Indian Benthos.*

- I. The rostrum is either ill-developed and does not conceal the ophthalmic somite, or if the rostrum is well developed and completely conceals the ophthalmic somite then the telson is small and the caudal swimmerets are not represented. Antennal peduncle five-jointed. Incisor edge of mandible entire           ...           ...           ...           ...           ...           PAGURIDEA.
- II. Rostrum well developed: telson and caudal swimmerets large foliaceous and symmetrical. Antennal peduncle either four-jointed, or if five-jointed then the postero-lateral angles of the carapace are held down by the outer angles of the first abdominal somite below and the prominent antero-external angle of the 2nd abdominal somite above and the incisor edge of the mandible is serrated           ...           ...           GALATHEIDEA.

PAGURIDEA, Henderson.

*Paguroidæ*, Boas, Vid. Selsk. Skr. 6 Række, Nat. og Math. Afd. I. 2, 1880, p. 189.

*Paguridea*, Henderson, Challenger Anomura, p. 40: Ortmann, in Bronn's Thier Reich, Malacostraca, p. 1143.

Carapace either elongate and subcylindrical or broad depressed and crab-like, the front not fused with the epistome.

The abdomen is usually asymmetrical soft and coiled in a spiral, or bent; or is sometimes abruptly flexed against the thoracic sternum as in crabs; very rarely is it quite symmetrical, well calcified, and straightly extended. The caudal swimmerets may either be present or altogether wanting: when present, they are usually asymmetrical.

Antennal peduncle five-jointed, the 2nd joint almost always carries a spiniform scale (antennal acicle).

The flagella of the maxillipeds, when present, are flexed inwards, and the external maxillipeds are pediform.

The thoracic legs never carry epipodites. The 1st pair are massive and chelate: the 5th pair are always, and the 4th pair often very much less developed than those in front of them.

It is very seldom that *all* the abdominal somites carry well developed paired appendages: as a general rule the appendages of the 2nd-5th somites of the female and of the 3rd-5th somites of the male, when present, exist on one side only.



*Synopsis of the family-groups of Paguridea.*

- I. Carapace usually elongate and subcylindrical: abdomen usually soft, it may be coiled or bent, but is never tightly tucked up against the thoracic sternum which is narrow or linear: the caudal swimmerets are always represented: the 4th pair of thoracic legs are very short PAGURODEA.
- II. Carapace crabshaped: abdomen broadly triangular and tightly flexed against the broad thoracic sternum: caudal swimmerets absent: the 4th pair of thoracic legs are as long as any of those in front of them LITHODEA.

## PAGURODEA, Henderson.

Henderson, Challenger Anomura, p. 48 (*et synonym.*).

Carapace almost always elongate and subcylindrical, much less well calcified behind the cervical groove than in front of it. Thoracic sternum narrow or linear.

Abdomen elongate; usually soft, asymmetrical, and either coiled to fit the spire of the dead mollusk-shell that the animal usually inhabits, or bent; only occasionally well-calcified symmetrical and straight. Caudal swimmerets present, narrow and falcate usually.

The first 3 pairs of thoracic legs are well developed, the 1st pair being massive and chelate and the 2nd and 3rd pairs being long stout and monodactylous; but the 4th and 5th pairs—one or both of which may be chelate or subchelate—are exceedingly short.

Paired appendages may be present on the 1st and 2nd abdominal somites of the male and on the 1st somite of the female, but on the 3rd–5th somites of the male and the 2nd–5th of the female the appendages are usually developed on one side only.

*Key to the Families of Pagurodeia of the Indian Benthos and Oligobenthos.*

- I. Abdomen perfectly straight and symmetrical, with all the terga well-developed, well calcified, and in close contact one with another, and with paired appendages on every somite from the 1st to the 6th ... PYLOCHELIDÆ.
- II. Abdomen usually coiled and soft, with the terga ill-developed: in the middle somites (3rd–5th), at least, the appendages are developed on one side only ... PAGURIDÆ.

Family *Pylochelidæ*, Ortmann.

*Pylochelidæ*, Ortmann in Bronn's Thier Reich, Malacostraca, p. 1144.

Body as straight and as bilaterally symmetrical as in any macrurous crustacean. The abdomen, which is extended straight behind the cephalothorax as

in any of the *Macrura*, has all its terga well developed and in close contact one with another, and ends in a symmetrical tail-fan. Thoracic sternum linear. Rostrum wanting or quite inconspicuous.

Antennal acicle well developed. Ophthalmic somite more or less exposed. The upper antennular flagellum is more than half the length of the peduncle.

External maxillipeds not widely separated from one another at base: their exopodite ending in a flagellum.

The thoracic legs of the 1st pair are equal and massive and chelate: those of the 2nd and 3rd pairs are long: those of the 4th and 5th pairs are very short and are subchelate.

The abdominal somites (telson of course excepted) have each a pair of appendages.

The gills are modified trichobranchiæ.

If *Pomatocheles* Miers (1879) should prove to belong here, the family name will have to be altered accordingly.

*Key to the Indian genera of the family Pylochelidæ.*

- I. The external maxillipeds are chelate. The hands of the 1st pair of thoracic legs are dorsally flattened and can be juxtaposed along their perfectly straight inner edge so as to form together an operculum that tightly closes the orifice of the cavity in which the animal lives ... .. PYLOCHELES.
- II. The external maxillipeds are non-chelate. The hands of the 1st pair of thoracic legs are subcylindrical ... .. PARAPYLOCHELES.

*Glaucothoe*, of which a small specimen, with a decided larval cast, has been dredged by the "Investigator" off the N. Maldive Atoll in 719 fathoms, agrees with the *Pylochelidæ* in its symmetry, but differs in the following particulars:—the abdomen, though perfectly segmented and having all its terga properly formed and in contact one with another, is folded on itself: the thoracic sternum, though narrow, is not linear: the large chelipeds are unequal: all the abdominal somites, *except the first*, have a pair of appendages: the gills appear to be phyllobranchiæ.

PYLOCHELES, A. M. Edw.

*Pylocheles*, A. Milne Edwards, Bull. Mus. Comp. Zool. VIII. 1880, p. 33: Milne Edwards and Bouvier, Mem. Mus. Comp. Zool. XIV. 1893, p. 17.

As pointed out by Milne Edwards, this genus marks the connexion between the *Thalassinidæ* and the typical *Paguridæ*. *Pomatocheles* Miers (1879) is closely allied and perhaps identical, as also is *Chiroplatæa* Spence Bate.

Body perfectly straight and bilaterally symmetrical as in any macrurous crustacean: the abdominal terga all in contact.

Carapace about half as long as the abdomen, well calcified dorsally but membranous laterally, the cervical groove well defined. No rostrum.

Abdominal terga and telson well calcified, as are the fairly well developed pleura of the 2-5 somites. Telson broad, divided into two parts by a transverse suture. Caudal swimmerets quite symmetrical, not so large or long as the telson, well calcified, the outer part of the dorsal surface of both exopodite and endopodite with a pavement of small sharp setose tubercles.

Ophthalmic scales small, widely separated: eyestalks long, eyes large.

The upper is much the longer of the two antennular flagella, and is more than half the length of the peduncle. The 2nd joint of the antennal peduncle has its antero-external angle produced to form a serrated spine inside which is a similar but larger spine (acicle).

The mandibles have a smooth subcircular molar facet lying at right angles with a strong sharp incisor process, and have a three-jointed incurved endopodite (palp).

The 1st and 2nd maxillæ have the coxopodite, basipodite, and endopodite well developed: in the 2nd maxillæ the coxopodite and basipodite are deeply cleft and the scaphognathite is posteriorly truncated.

All 3 pairs of maxillipeds have well developed flagellate exopodites, but none of them except the 1st pair have epipodites, nor are there any epipodites on any of the thoracic legs. The 2nd and 3rd (external) maxillipeds are pedi-form and 7-jointed, the external maxillipeds, which are in contact with one another at base, ending in a nearly perfect chela in which the dactylus is a little longer and slenderer than the fixed finger.

The thoracic legs of the 1st pair are equal, massive, and symmetrical, having the wrist and hand twisted inwards so that the outer surface of the hand becomes superior: the anterior edge of the carpus is produced as a crest that overhangs the hand, and the hands, which have the palm dorsally flattened, can be juxtaposed along the whole of their perfectly straight inner edge and can be flexed vertically almost at right angles with the carpus, so as to form an operculum to the cavity in which the animal hides itself: the fingers are short with sharp strongly-calcified tips.

The legs of the 2nd and 3rd pairs are long slender and compressed, and end in elongate curved dactyli: those of the 4th and 5th pairs are short and subchelate, their dactyli being very short and claw-like and a good deal concealed in setæ.

The abdominal appendages of the 1st somite are uniramous in both sexes, and in the male have an almost foliaceous tip: those of the 2nd-5th somites

are slender and biramous in the female, but are uniramous in the male, in which sex also those of the 2nd somite are particularly long and strong and end in a spathulate joint.

The gills are 14 on either side, disposed as follows:—a pair of arthro-branches to each segment from the IXth (external maxillipeds) to the XIIIth, and a pleurobranch on each segment from the XIth to the XIVth. The gill-elements are filaments arranged in double rows on either side of a shaft (quadri-serial).

The genus is represented in moderate depths in the Caribbean Sea, the Andaman Sea, and the Sea of Banda.

### 1. *Pylocheles miersii*, Alcock and Anderson.

*Pylocheles miersii*, Alcock and Anderson, Ann. Mag. Nat. Hist., Jan. 1899, p. 14.  
ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLIII. FIG. 4.

Carapace cuboidal, its membranous lateral walls being vertical, its anterior border faintly sinuous, its dorsum quite free of setæ.

The abdominal terga 2-5 are separated from their pleura by a groove, and the pleura 2-4 each have a longitudinal crescentic groove. The 6th tergum is much longer than any of the others. The posterior segment of the telson is obscurely bilobed. There are setæ on the edges of the pleura and on the surface and edges of the telson and caudal swimmerets, but not on any other part of the abdomen.

Ophthalmic scales extremely short: eyestalks half as long as the carapace, a narrow strip along their sides is imperfectly calcified: eyes markedly reniform.

The 2nd joint of the antennular peduncle is the longest and the 3rd the shortest: the upper antennular flagellum is nearly two-thirds the length of the carapace.

The inner of the 2 acicles of the 2nd joint of the antennal peduncle reaches more than halfway along the eyestalk, the outer is shorter, both are obscurely serrated: the antennal flagellum is longer than the carapace.

The external maxillipeds reach as far as the tip of the eyes.

The great chelipeds, which are perfectly equal, are not quite two-thirds the length of the body, nearly half their extent being contributed by the hand. The merus and ischium are smooth, and their common inner surface is marked by an elongate-oval ring of imperfectly calcified integument: the trigonal carpus has its lower border very short, but its upper surface is three-fourths the length of the palm, is finely rugose, and has its anterior edge produced to form a salient bilobed and finely serrated setose crest: the lower surface of the hand is convex and smooth, but the upper surface is flat, closely pitted and thickly covered with



setæ like a mat, and has its edges serrulate: the fingers are not much more than half the length of the palm.

The 2nd and 3rd pair of legs closely resemble one another, both having smooth compressed joints and ending in a long acute dactylus, which is at least as long as the propodite and longer than the merus: the 2nd pair, which are slightly the longer, are about as long as the body without the telson: both pairs, when extended, reach beyond the 1st pair.

The 4th pair of legs are as long as the carapace: their joints, though compressed, are stout, and their dactylus is a short stout claw, which forms with the produced angle of the setose propodite, a subchela.

The 5th pair of legs are shorter than the carapace: they resemble the 4th pair in having a setose propodite and a very short claw-like dactylus, which, however, folds against the distal end of the propodite to form an imperfect subchela.

In the male the 2nd pair of abdominal appendages are two-thirds the length of the carapace: they are strongly calcified, and their terminal joint is angularly club-shaped.

Colours in life: upper surface of carapace and legs orange, lower surface white, eyes brown, eggs bright yellow. Spirit specimens are cream-colour with some iridescence on the gastric region and on most of the abdominal terga.

In a male the length of the carapace is 10 millim., of the abdomen 21 millim. An egg-laden female is a little larger. The eggs though large are fairly numerous.

All the specimens known were found tightly impacted in sunken drift twigs of bamboo and mangrove.

Andaman Sea, off the east coast of North Andaman Island, 185 fathoms.

Regd. Nos.  $\frac{2202-2205}{10}$ :  $\frac{2207-2211}{10}$  (Types of the species).

#### PARAPYLOCHELES, n. gen.

Closely resembles *Pylocheles* and *Mixtopagurus*.

Differs from *Pylocheles* in the following characters *only*:—

A little rostrum projects between the bases of the eyestalks, and the lineæ anomuricæ are distinct, though they do not reach the posterior border of the carapace.

Though the abdomen is faultlessly symmetrical, and though all the abdominal terga are well defined and in close contact, yet there are no pleura, and on the ventral surface of the abdomen (except for the presence of appendages) there is no segmentation: moreover some of the terga are somewhat ill-calcified. The

telson is not divided by a transverse suture, and is not so long as the caudal swimmerets.

The ophthalmic scales are contiguous and the eyes are small and pale.

The external maxillipeds are not chelate, though they are in close contact with one another at base.

The thoracic legs of the 1st pair, though symmetrical and equal and more massive than any of the other legs, have a carpus of ordinary form and a sub-cylindrical hand not modified to form a stopper.

In the female the abdominal appendages of the 1st pair are slender and uniramous, and those of the 2nd-5th pairs are slender and biramous with one ramus rudimentary: in the male all, from the 1st to the 5th, are uniramous and only those of the 2nd pair are of any size.

The branchial formula is exactly the same as that of *Pylocheles*, but the arthrobranchiæ of somite IX (external maxillipeds) are mere non-plumose fleshy lobes, there are thus only 12 *functional* branchiæ on either side, namely, 4 pairs of arthrobranchiæ (on somites X.-XIII.), and 4 pleurobranchiæ (on somites XI.-XIV.).

From *Mixtopagurus* it differs in having the abdomen softer and the ophthalmic scales in contiguity, also in having only 12 functional branchiæ on either side.

## 2. *Parapylocheles scorpio*, Alcock.

*Pylocheles scorpio*, Alcock, Ann. Mag. Nat. Hist., March, 1894, p. 244.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE IX. FIG. 7.

Body long and slender, with a wasp-like constriction between the cephalothorax and abdomen, cephalothorax subcylindrical. Carapace half the length of the abdomen, strongly calcified smooth and polished in front of the cervical groove, behind which it is less strongly calcified dorsally and membranous laterally: the frontal margin is much excavated behind the eyestalks, between which a small rostrum projects, and on the outer angle of either orbital notch is a pair of spinules.

All the abdominal terga are distinct and symmetrical: the 1st which is extremely small, and the 6th which is suboval, are strongly calcified; but the 2nd-5th, which are subrectangular plates, are feebly calcified, except a patch in the middle of the posterior border of the 5th: their edges are setose, as also is the surface of the 6th and of the telson. The caudal swimmerets are perfectly symmetrical; the outer part of the dorsal surface of both endopodite and exopodite has a pavement of small setose bead-like tubercles.

The eyestalks, which are about a third the length of the carapace, taper from a broadish base up to a small pale eye: their dorsal surface is finely serrated and setose towards the edges.

The antennular peduncle is more than half the length of the carapace, the 3rd joint being the longest and the basal joint the shortest: the upper flagellum, which tapers to a setaceous filament, is nearly as long as the peduncle, the lower is, in the female, a short fine filament.

The antennal peduncle exceeds the eye by nearly as much as it falls short of the antennular peduncle: the finely serrated acicle reaches a little beyond the eye: the flagellum is over half the length of the body.

The large chelipeds, which are equal to one another and quite symmetrical, are about as long as the abdomen: their upper surface is setose, especially on the hand: their ischium and merus are elegantly toothed along the inner edge, where they meet their fellows, across the mouth parts, in a perfectly straight line: their hand, which is subcylindrical, is about twice the greatest length of the carpus: the fingers, which are a little more than half the length of the palm, have hard horny tips.

The 2nd and 3rd thoracic legs are a little longer than the chelipeds: their joints are smooth and compressed, with sparsely setose edges, and though the dactylus is a long joint it is only about half the length of the propodite.

The 4th and 5th legs (coxal joint included) are only about half as long as the carapace: both are subchelate and have a short broad propodite and a tiny claw-like dactylus, the propodite having a pavement-like patch of setose granules on its outer surface.

In the female the appendages of the 1st abdominal somite are uniramous, those of all the other somites are biramous: in the male the abdominal appendages 1-5 are all uniramous.

Colour in life, dull chalky red.

The female, is 28 millim. long, the carapace being 9 millim., the male is larger.

Andaman Sea, 405 fathoms.

$\frac{6891}{9}$  and  $\frac{1839}{10}$  (Types of the species).

### Family *Paguridae*, Dana.

Dana, U.S. Expl. Exp. Crust. pt. i. p. 435: Ortmann in Bronn's Thier Reich, Malacostraca, p. 1145.

Body sometimes straight and symmetrical, but the abdomen is more usually asymmetrical and coiled in a spiral: the abdominal terga are never *all* broad well calcified plates in close contact one with another, but the abdomen is generally soft and has its segmentation more or less obscured. Rostrum wanting or quite inconspicuous.

Ophthalmic somite more or less exposed. Antennal acicle well developed.

The exopodite of the external maxillipeds ends in a flagellum.

The thoracic legs of the 1st pair, which are chelate and massive, may be either equal or very unequal: those of the 2nd and 3rd pairs are long, and those of the 4th and 5th pairs very short.

*Paired* appendages are never present on *all* the abdominal somites.

The gills are occasionally modified trichobranchiæ, but are usually phyllobranchiæ.

*Synopsis of the genera of Paguridæ of the Indian Benthos and Oligobenthos.*

- I. The first two abdominal somites of the male have each a pair of appendages:—
  1. The first abdominal somite of the female is destitute of appendages: the exopodite of the 1st maxillipeds is a falcate-foliaceous plate without flagellum: the chelipeds are remarkably unequal: the gills, which are modified trichobranchiæ, are 11 on either side:—
    - i. Eystalks long and slender, eyes small: gill-filaments quadriserial ... .. PARAPAGURUS.
    - ii. Eystalks stout, eyes large: gill-filaments biserial SYMPAGURUS.
  2. The first abdominal somite of the female has a pair of appendages: the exopodite of the 1st maxillipeds ends in a flagellum: the chelipeds are subequal or equal. In the female the abdomen is furnished on one side with a fleshy lobe that assists in forming a brood-pouch:—
    - i. Tail-fan asymmetrical: eystalks long and slender: 4th pair of thoracic legs non-chelate: gills 14 on either side—phyllobranchiæ ... .. PAGURISTES.
    - ii. Tail-fan symmetrical: eystalks stout: the 4th pair of thoracic legs are perfect chelæ: gills 13 on either side—modified phyllobranchiæ. The animal lives, not in a shell, but under a portable blanket formed by the coenosarc of a colony of sea-anemones ... .. CHLÆNOPAGURUS.
- II. The first two abdominal somites of the male, and the first abdominal somite of the female, are destitute of appendages: the vas deferens of the male protrudes, as a short curved tube, from the coxa of the 5th right thoracic leg. Gills as in *Parapagurus*. Eystalks stout, not elongate ... .. PAGURODES.

PARAPAGURUS, S. I. Smith.

*Parapagurus*, S. I. Smith, Trans. Connect. Acad. V. 1878-82 (1879), p. 50, and Bull. Mus. Comp. Zool. X. 1882-83, p. 20: Henderson, Challenger Anomura, p. 85: A. Milne Edwards and Bouvier, Mem. Mus. Comp. Zool. XIV. 1893, No. 3, p. 26, and "Hirondelle" Crust. Brachyures et Anomures (Monaco, 1894), p. 63: Stebbing, South African Crust., 1900, p. 27.

Body markedly asymmetrical. Carapace larger than the abdomen, strongly



calcified in front of the cervical groove, almost coriaceous or membranous behind it, the rostral prolongation broad and inconspicuous.

Abdomen coiled in a spiral, for the most part soft and submembranous, the first two terga are, however, fairly well calcified, as are also the last tergum and the telson. The tucked-in caudal swimmerets are asymmetrical, those of the left side being larger than those on the right: on both sides the exopodite and endopodite are somewhat claw-like, and have on their dorsal surface a pavement of sharp beady granules.

The ophthalmic scales, which are sharp and conspicuous, are separated by a considerable interval: the eyestalks are usually long and slender.

The antennular peduncle is nearly as long as the carapace: the upper antennular flagellum, which is the longer, is not half the length of the peduncle.

The acicle of the antennal peduncle is long and slender.

The mandibles have a prominent and trenchant incisor process separated from the small receding molar process by a groove, and an incurved 3-jointed palp.

The 1st and 2nd maxillæ have the coxopodite, basipodite, and endopodite well developed: in the 1st maxillæ the coxopodite is recedent, in the 2nd maxillæ the coxopodite and basipodite are deeply cleft and the scaphognathite is subacutely produced.

All 3 pairs of maxillipeds have strong exopodites: those of the 1st maxillipeds are simple non-flagellate falciform plates: those of the 2nd and 3rd maxillipeds are slender and end in long flagella: only the 1st pair of maxillipeds have an epipodite, and there are no epipodites to any of the thoracic legs. The 2nd and 3rd (external) maxillipeds are simple and 7-jointed, but without any movement between the basis and ischium: the external maxillipeds are separated at base by a considerable interval.

The thoracic legs of the 1st pair are remarkably unequal, the right being much larger than the left: the fingers open in an oblique plane and have calcareous or slightly corneous tips.

The legs of the 2nd and 3rd pairs are of remarkable length, and end in very long somewhat twisted dactyli: those of the 4th and 5th pairs are extremely short, and end in little claw-like dactyli, the 4th pair being subcheliform and the 5th pair minutely cheliform.

In the male the first two abdominal somites have each a pair of uniramous appendages modified for copulation, and the 3rd-5th somites have, on the left side only, each a biramous appendage of which the inner ramus is rudimentary. In the female the 1st abdominal somite is destitute of appendages, and the 2nd-5th have, on the left side only, each a biramous appendage.

The gills are 11 on either side, disposed as follows:—a pair of arthrobranchs

on each segment from the IXth (external maxillipeds) to the XIIIth, and a pleurobranch on somite XIII (penultimate thoracic). The gill-elements are filaments arranged in double rows on either side of a shaft (quadriseserial).

In the female the genital opening is present on the left side only.

Eggs small and numerous.

*Key to the Indian species of Parapagurus.*

I. The ophthalmic scales are simply spiniform:—

1. The adult is large: the chelipeds are thickly pilose, the larger one of the right side being at least 3 times as long as the carapace ... .. *P. pilosimanus.*
2. The adult is minute: the chelipeds are glabrous and the larger one (right) is much less than 3 times the length of the carapace; the outer surface of the hand of the larger cheliped is longitudinally traversed near the upper border by a fine granular ridge ... .. *P. minutus.*

II. The ophthalmic scales have the tip serrated:—

1. The hand forms about a third of the length of the enlarged right cheliped, in which the palm is a subquadrangular joint about twice as long as broad ... .. *P. andersoni.*
2. The hand forms about two-fifths of the length of the enlarged right cheliped, in which the palm is a suboval joint not much longer than broad ... .. *P. andersoni* var. *brevimanus.*

3. *Parapagurus pilosimanus*, S. I. Smith.

*Parapagurus pilosimanus*, S. I. Smith, Trans. Connect. Acad. V. 1879, p. 51, and Proc. U. S. Nat. Mus. III. 1881, p. 423 and VI. 1883, p. 33, pl. v. figs. 3-5 and pl. vi. figs. 1-4a, and Bull. Mus. Comp. Zool. X. 1882-83, p. 20, pl. ii. fig. 4, and Report U. S. Fish Comm. 1884 [p. 10], and 1886 [p. 39]: Pocock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 430: A. Milne Edwards and E. Bouvier, Ann. Sci. Nat. Zool. (7) XIII. 1892, p. 204, and Mem. Mus. Comp. Zool. XIV. 1893, No. 3, p. 28, and "Hirondelle" Brachyures et Anomures (Monaco, 1894) p. 64, pl. ix. figs. 1-17, and "Hirondelle" Crust. Decapodes (Monaco, 1899), p. 55, pl. i. fig. 1 (var. *abyssorum*): and Caullery, "Candan" Crust., Ann. Univ. Lyon, 1896, p. 386.

*Eupagurus jacobii*, A. Milne Edwards, Bull. Mus. Comp. Zool. VIII. 1880, p. 42.

*Parapagurus abyssorum*, Henderson, Challenger Anomura (1888), p. 87, pl. ix. fig. 2: Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 199.

*Parapagurus pilosimanus abyssorum*, Faxon, Mem. Mus. Comp. Zool. XVIII. 1895, p. 68.

Carapace strongly calcified in the gastric and hepatic regions, less strongly in the narrow cardiac region, parchment-like in the branchial regions; the rostral prolongation broad, little prominent, and rounded off; the posterior border deeply excavated in the middle line on account of the bulging of the branchial regions: on the sides, and in the region of the conspicuous cervical groove are some tufts of setæ.

The abdominal terga, except the first two which are parchment-like and the last two which are strongly calcified, are narrow and widely separated from one

another, so that the greater part of the abdomen is soft: the 6th tergum is deeply grooved transversely and feebly grooved longitudinally, the telson is obscurely and asymmetrically bilobed posteriorly.

Ophthalmic scales spiniform, acute: the eyestalks, which are dorsally setose, are about half the extent of the frontal border of the carapace in length: the eyes are small.

The antennular peduncle is about as long as the carapace, its third joint being by far the longest: the upper antennular flagellum, which is much longer than the lower, is hardly half as long as the peduncle.

The antennal peduncle reaches only as far as the end of the 2nd joint of the antennular peduncle: the acicle, which is setose and slightly twisted, reaches to or beyond the end of the antennal peduncle: the flagellum is about twice as long as the body.

The external maxillipeds reach some way beyond the end of the antennal peduncle: they are setose and the inner border of the ischium is toothed: the sternum between them carries a pair of spines.

The great chelipeds are thickly tomentose, especially the distal end of the merus, both surfaces of the carpus, and the outer surface of the hand, and the right is much longer and very much bulkier than the left.

In the adult, the right cheliped is considerably longer than the body, between half and two-fifths of its length being contributed by the hand, which is also the broadest joint: the carpus, which is the next largest joint, is as long as the palm, and the dactylus is shorter than the palm: the inner border of the ischium is crenulate, the upper surface of the trigonal merus is rugose, and the subcylindrical carpus and the compressed but tumescent palm are granular: on the cutting-edge of the fingers are 2 or 3 molariform teeth.

In the adult, the small left cheliped is about as long as the right cheliped *minus* the hand: the carpus is nearly as long as the hand, the dactylus is a little longer than the palm, and there are no enlarged teeth on the cutting-edge of the fingers.

The 2nd and 3rd pairs of thoracic legs are very long, rather slender, smooth and compressed: their dactylus, which is the longest joint, being longer than the carpus and propodite combined, is curved and slightly twisted and is more or less covered with stiffish setæ: the 3rd pair, which are a little longer than the 2nd, reach almost a dactylus length beyond the tip of the large cheliped.

The legs of the 4th pair are about two-thirds, and those of the 5th pair are about three-quarters, the length of the carapace measured in the middle line: in both, the dactylus is a minute claw, and both are setose, especially at the far end of the propodite, where, on the outer surface, is a rasp-like patch or strip of granules.

The 1st pair of abdominal appendages of the male are strongly channelled along the inner surface; those of the 2nd pair are grooved, slightly twisted and setose near the tip.

This species grows to a large size, and although occasionally specimens are found inhabiting a small gastropod shell along with a single encrusting sea-anemone, yet as a general rule they live embedded in the semi-cartilaginous coenosarc of an *Epizoanthus*-colony from which all traces of the shell that formed the original bond of commensalism have disappeared by absorption.

In a large male from the Laccadive Sea the length of the carapace is 22 millim., that of the abdomen when unravelled 50 millim., that of the large cheliped 70 millim., that of the small cheliped 45 millim.

From the Arabian Sea, near the Laccadives and Malabar coast, 705, 740, 824, 836, 937 and 1200 fathoms: from the Bay of Bengal, 1644, 1748, 1803 and 1997 fathoms.

Our specimens have been compared with "Albatross" specimens, from off the coast of S. Carolina, with which they agree entirely.

Regd. Nos.  $\frac{6171}{9}$  :  $\frac{6881-6884}{9}$  :  $\frac{8750-8751}{9}$  :  $\frac{8755}{9}$  :  $\frac{1969-2000}{10}$  :  $\frac{2422}{10}$  :  $\frac{2642}{10}$  :  $\frac{3749}{10}$  .

#### 4. *Parapagurus Andersoni*, Henderson.

*Parapagurus andersoni*, Henderson, Journ. Asiatic Soc. Bengal, Vol. LXV. pt. 2, 1896, p. 529.  
ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XXXII. FIG. 2.

"The anterior portion of the carapace is moderately convex, both from side to side, and from before backwards; the surface is slightly uneven, with a few tufts of hair near the lateral and anterior margins. The median frontal projection is fairly prominent, while the lateral projections are scarcely indicated at all. The portion of the carapace behind the cervical grooves is membranous, and even the cardiac area is uncalcified. The eye-stalks are slightly concave on their inner surface, and a few rather long hairs are found on the upper surface of each; the corneae are small, but deeply pigmented. The ophthalmic scales are small and laterally compressed, each terminating in four small apical denticles. The antennal peduncles are broad, and exceed the eye-stalks by about the length of the last peduncular joint; the acicle has a slight sigmoid curve, and extends to the end of the peduncle, while its inner margin is provided with a row of spinules. The external prolongation of the second joint of the antennal peduncle is acute, but very short; the terminal joint of the peduncle is broad, and flattened from above downwards. The antennal flagellum is more than twice the length of the body. The antennular peduncles exceed the eye-stalks by the whole of their terminal joint and about two-thirds of the length of their penultimate joint.

"The chelipeds are elongated and slender, with the joints faintly pubescent, and armed with subspiniiform granules. The carpus is about one-fourth of its



length longer than the merus ; it is practically cylindrical, and the whole surface is uniformly granulated, but the granules or spinules as they might almost be termed, are most marked on the upper surface. The propodus is slightly flattened when compared with the carpus, though both its surfaces are really somewhat convex ; the granules are practically confined to its inner and outer margins, where they have assumed a distinct spinose character ; they are strongly marked also on the corresponding margins of the fingers. The upper surface of the hand is pubescent, but otherwise almost smooth. The left chelipede extends to a point opposite the middle of the carpus of the larger chelipede. It is everywhere clothed with rather long hairs, and the upper margin of the carpus is carinated.

“ The ambulatory legs are very long and slender, even exceeding the chelipedes, and they are everywhere glabrous. The anterior margin of all the joints, but especially the meri, carries a few setose hairs, and there is a small spinule at the anterior distal end of the carpi. The dactyli are slightly bent, and flattened towards their apices ; their apical portions carry long setose hairs.

“ The single specimen measures as follows :—

Length of carapace	...	...	...	...	12 mm.
„ „ right chelipede	...	...	...	...	52 „
„ „ left chelipede	...	...	...	...	27 „

“ The gill-filaments are somewhat flattened, and arranged, as usual in the genus, in four rows ; the filaments of each outer row are about two-thirds the length of, and at the same time somewhat narrower than, those of the inner row.”

Arabian Sea, off the N. Maldivé Atoll, and off the Travancore coast, 719 and 430 fathoms.

Inhabiting shells of *Bathybembia wood-masoni* and *Turbo indicus* encrusted with a sea-anemone.

Regd. Nos.  $\frac{8817-8818}{9}$  (Types of the species) :  $\frac{2390}{10}$ .

*Parapagurus andersoni* var. *brevimanus*.

*Vide* Henderson, J. A. S. B., Vol. LXV, pt. 2, 1896, p. 531.

This variety only differs in the form of the great cheliped, which is altogether much shorter and stouter, with the hand constituting only about two-fifths of its total length : the palm is suboval and hardly longer than the dactylus, its greatest breadth being nearly equal to its length.

It much resembles *P. affinis* Henderson, but differs in having the large cheliped slenderer and more scabrous and the ambulatory legs (2nd and 3rd pair) longer and slenderer.

Inhabiting shells of *Bathybembia wood-masoni*, *Turbo indicus*, *Natica*, and other species, which are encrusted with a sea-anemone.

Arabian Sea, 430, 464, 487, 595-556, and 719 fathoms.

Regd. Nos.  $\frac{8820}{9} : \frac{2394}{10} : \frac{3745-3748}{10}$ .

### 5. *Parapagurus minutus*, Henderson.

*Parapagurus minutus*, Henderson, J. A. S. B., Vol. LXV. pt. 2, 1896, p. 531.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XXXII. FIG. 3.

“In this minute species, which appears to be fully adult, as shown by the presence of eggs, the largest example has the carapace, chelipeds, and legs glabrous with a white porcellanous aspect. In the smaller specimens there is a slight pubescence on all the above named parts, including the eye-stalks, where the hairs may be rather long. Hairs are met with in this last situation even in the largest specimen.

“The anterior portion of the carapace is glabrous and regularly convex, with the exception of a slight wrinkling antero-laterally. The median frontal projection is scarcely indicated. The eye-stalks exhibit considerable basal dilatation, and the narrowed apex carries a reduced but deeply pigmented cornea. The ophthalmic scales are minute, and terminate in a subacute point. The antennal peduncles slightly exceed the eye-stalks; the acicle is almost straight, ciliated, and faintly spinose on its inner margin; the external prolongation of the second joint exhibits considerable depth, and its apex can scarcely be termed acute. The antennular peduncles exceed the eyestalks by more than the length of the last peduncular joint—this however is almost a generic character. The antennal flagellum is apparently not longer than the body, if as long.

“The right chelipede has the joints of a white porcellanous aspect. The hand (omitting the fingers) is slightly longer than the carpus, but the proportion seems to vary slightly in different specimens. The length of the hand is not quite twice its breadth. In the largest specimen the joints of the chelipede are almost smooth, there being only a faint denticulation, or almost granulation, visible on the margins of the hand and fingers, but in other specimens there is a regular minute serration, and in these cases the margins are thinner or less rounded. In some cases minute granules are visible on the under surface of the hand and wrist. In one or two examples the tip of the dactylus is bent under that of the immobile finger. The smaller or left chelipede extends to about the middle of the hand of the larger chelipede, and in some cases even to the articulation of the dactylus.

“The ambulatory legs are unarmed, though faintly pubescent, especially the terminal portions of the dactyli. The dactyli are not quite twice the length of the propodi.

“The gills are similar to those of *P. andersoni*, but the lamellae are narrower. The eggs are moderately large, and the oviducal opening of the female is, as usual in the genus, present only on the left side.

“The largest specimen is a female with ova, which measures as follows:—

Length of body	...	...	...	16 mm.
„ „ carapace	...	...	...	5.5 „
„ „ right chelipede	...	...	...	10.5 „
„ „ first right leg	...	...	...	16 „

Arabian Sea, off the N. Maldive Atoll, 719 fathoms.

Inhabiting shells of *Dentalium*. One of the shells is encrusted with a colony of *Epizoanthus*.

Regd. Nos.  $\frac{8819}{9}$  :  $\frac{1082-1088}{19}$  (Types of the species).

### SYMPAGURUS, S. I. Smith.

*Sympagurus*, S. I. Smith, Proc. U. S. Nat. Mus. VI. 1883 (1884), p. 37: Henderson, Challenger Anomura, p. 52: A. Milne Edwards and E. L. Bouvier, Mem. Mus. Comp. Zool. XIV. No 3, 1893, p. 58.

Differs from *Parapagurus* only in the fact that the gill-elements instead of being arranged in a double row on either side of a stem (quadriseiral) are in a single row on either side of a stem (biseiral) like phyllobranchiæ. The gills, however, differ from ordinary phyllobranchiæ by reason of the narrowness of the individual gill-plates. Their number and disposition is the same as in *Parapagurus*, namely 11 on either side—a pair of arthrobranchiæ to every somite from the IXth to the XIIIth, and a single pleurobranch on the XIIIth.

The mouth-parts resemble those of *Parapagurus*, the exopodite of the 1st maxillipeds having no flagellum.

The other appendages of the body resemble those of *Parapagurus* except that, in the Indian species, the eye-stalks are shorter and wider and the eyes more dilated, and the antennal acicle is not so long.

### 6. *Sympagurus monstrosus* (Alcock).

? *Parapagurus monstrosus*, Alcock, Ann. Mag. Nat. Hist., March 1894, p. 243.

*Sympagurus monstrosus*, Henderson, Journ. Asiatic Soc. Bengal, Vol. LXX. pt. 2. 1896. p. 535.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XXXII, FIG. 4.

The well-calcified anterior portion of the carapace is convex, smooth, and polished, with the gastric region and the hepatic regions sharply circumscribed by deep incisions; the frontal margin is sinuous and the rostral projection, which is carinated, is inconspicuous; the posterior portion of the carapace is extremely thin, but is quite appreciably and uniformly calcified; its surface is smooth and bears some long scattered hairs.

The eye-stalks are short and stout, less than one-third the length of the carapace, and gradually increase in diameter towards the expanded cornea; dorsally they are crested by a line of long hairs; the ophthalmic scales are acute. The antennular peduncles exceed the eye-stalks by the whole length of the terminal joint. The antennal peduncles are but slightly longer than the eye-stalks; their basal joint is expanded and has the usual strong spine at the antero-external angle; the antennal acicle is doubly curved, with the inner margin setose and strongly serrated; its point reaches just beyond the origin of the flagellum; the last is not far short of twice the length of the body.

The chelipeds are most remarkably unequal, the right exceeding the left in bulk many times and in length by somewhat more than its dactylopodite; both are pubescent above, and the right is sharply granular above and slightly so below. In the right cheliped the meropodite and carpopodite are also pubescent below, and the margins of the latter, like those of the palm and fingers, are closely and sharply serrated, the inner margin of the palm having a double row of denticles. The left cheliped is hardly more massive than the corresponding portion of the second or third leg, and is smooth throughout. In the second and third legs the upper borders of the merus, carpus, and propodite are crenulate or bluntly serrate, and, like the upper border of the long sinuous dactylus, hairy.

A common species, inhabiting many kinds of Gastropod shells, which are usually encrusted with a sea-anemone.

From the Bay of Bengal, 145-250, 240, and 281-258 fathoms; the Andaman Sea, 405 fathoms; and the Arabian Sea, off Ceylon and the Malabar coast, 142-400, 224-284, 360, and 464 fathoms.

Regd. Nos.  $\frac{4222}{7}$ ;  $\frac{4224}{7}$ ;  $\frac{6885-6890}{9}$ ;  $\frac{8752-8754}{9}$ ;  $\frac{1028-1077}{10}$  (Types of the species):  $\frac{1115}{10}$ ;  $\frac{1840}{10}$ ;  $\frac{2023-2027}{10}$ ;  $\frac{3750-3751}{10}$ ;  $\frac{3895}{10}$ .

#### PAGURODES, Henderson.

*Pagurodes*, Henderson, Challenger Anomura, p. 94.

Differs from *Parapagurus* in the following characters only:—

The rostral prolongation is a little more pronounced. The eyestalks are short.

Though the great chelipeds are unequal they are not so markedly unequal, the right being bulkier but not much longer than the left.

In the male the vas deferens protrudes as a short curved tube from the coxa of the 5th thoracic leg, and the first two abdominal somites are destitute of appendages.



*Key to the Indian species of Pagurodes.*

- I. Eyestalks compressed, swollen at base, barely reaching beyond the end of the 1st joint of the antennular peduncle: the antennal acicle reaches beyond the end of the antennal peduncle: under the lens the upper surface of the chelipeds (fingers excepted) and first 2 pairs of legs (daetyli excepted) is uniformly frosted with fine granules ... *P. inarmatus.*
- II. Eyestalks subcylindrical, reaching more than halfway along the 2nd joint of the antennal peduncle: the antennal scale does not reach the end of the antennal peduncle: the chelipeds and legs have some transverse subsquamiform rugæ, and the carpus of the chelipeds has two longitudinal rows (including the inner border) of granules, but their surface is not uniformly frosted ... .. *P. limatulus.*

7. *Pagurodes sp.? inarmatus*, Henderson.

*Pagurodes inarmatus*, Henderson, Challenger Anomura, p. 94, pl. x. fig. 5.

A small female, which agrees completely with Henderson's description and figure, and is, I think, this species, was dredged off the Travancore coast in 487 fathoms. The shell that it inhabited has not been preserved.

The Challenger specimens were taken off Marion Island in the south-western part of the Indian Ocean, and off New Zealand, but in a much greater depth.

Regd. No.  $\frac{3752}{10}$ .

8. *Pagurodes sp.? limatulus*, Henderson.

*Pagurodes limatulus*, Henderson, Challenger Anomura, p. 97, pl. x. fig. 6.

Three small specimens which agree entirely with Henderson's description and figure, and are almost certainly the same species, were dredged off the Travancore coast in 430 fathoms.

The Challenger specimens were taken to the south of the Philippines in 500 fathoms.

Regd. No.  $\frac{2391-2393}{10}$ .

PAGURISTES, Dana.

*Paguristes*, Dana, U. S. Expl. Exp. Crust., part 1., p. 436: Stimpson, *Proc. Acad. Nat. Sci. Philad.* 1858, p. 73: Heller, *Crust. eurol. Europ.*, p. 172: Henderson, Challenger Anomura, p. 77.

Body asymmetrical. Carapace most strongly calcified in front of the cervical groove, and with the rostral projection conspicuous and often acute.

Abdomen coiled in a spiral, the first two terga may be semicalcareous and the last tergum and the telson are well calcified, but otherwise it is soft. The

caudal swimmerets are asymmetrical and claw-like and have on their dorsal surface a pavement of granules.

The ophthalmic scales, which are conspicuous, are separated by a considerable interval: the eyestalks are remarkably long and slender.

The antennular peduncle is long, and the upper antennular flagellum, which is much the longer of the two, is also of considerable length.

The antennal acicle is of good length, the flagellum is usually ciliated.

The mouth-parts differ from those of *Parapagurus* only in the following particulars:—in the 1st maxillæ the coxopodite is not recedent, in the 2nd maxillæ the scaphognathite is obliquely truncated, the falciform exopodite of the 1st maxillipeds ends in a flagellum, and the 1st maxillipeds have no epipodite. As in *Parapagurus*, the external maxillipeds are separated from one another at base.

The chelipeds are subequal or equal; their fingers, which move in a horizontal plane, are calcareous or corneous at tip. The 2nd and 3rd pairs of thoracic legs are long and end in long stout dactyli: the 4th and 5th pairs are short, the 4th pair being simple (non-chelate).

In the male the 1st 2 abdominal somites have each a pair of uniramous appendages modified for copulation; in the female the 1st somite alone has a pair of appendages, the 2nd somite having an appendage on one side only: in the female also a membranous lobe springs from one side of the 4th somite to form the outer wall of an egg-pouch.

The gills are 14 on either side, namely, 5 pairs of arthrobranchs (somites IX–XIII) and 4 pleurobranchs (somites XI–XIV) and are phyllobranchiæ.

### 9. *Paguristes puniceus*, Henderson.

*Paguristes puniceus*, Henderson, Journ. Asiatic Soc. Bengal, Vol. LXV. pt. 2, 1896, p. 527.  
ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XXXII. FIG. 1.

“The median frontal projection is less prominent than usual in the genus, and varies considerably in length in different individuals; in some specimens the apex is subobtuse, and scarcely reaches the base of the ophthalmic scales, whereas in others it is acute, and extends almost to the middle of the scales. The lateral frontal projections are almost as prominent as the median one. The anterior surface of the carapace is somewhat rugose, with a few scattered hairs, and there is a marginal sulcus following the contour of the anterior margin. On the posterior membranous region of the carapace, the median or cardiac area is reduced to a linear elevation, bounded by a sulcus on either side, and the two branchial areas thus almost meet in the middle line. This cardiac elevation widens out slightly in front immediately behind the cervical groove. The eyestalks are shorter than usual in the genus, just reaching the end of the antennal

peduncle, or even in some cases slightly falling short of this, and extending to about the middle of the last joint of the antennular peduncle. The ophthalmic scales are rather small, and separated by a considerable interval, with their apices acute and entire. The antennal acicle extends to about the middle of the terminal joint of the antennal peduncle; it is straight and acute, with a few short spines on its inner margin, and sometimes also on its outer margin, concealed by the hairs with which the acicle is clothed. The external prolongation of the second joint of the antennal peduncle is bispinose in some specimens at least; the third joint is produced inferiorly into a strong spine. The antennal flagellum is of moderate length, extending to the tips of the chelipedes, and is fringed with long hairs.

“The chelipedes as well as the ambulatory legs are clothed with long silky hairs. The chelipedes are subequal in most specimens, but in some males the right is larger. The carpus, propodus, and dactylus are armed with short acute spines, some of which are horny tipped, and the majority give rise to bunches of silky hairs. On the upper surface of the carpus there is a median longitudinal smooth area, with rows of spinules on either side. The spines are arranged irregularly on the upper surface of the hands and fingers, but there are always three or four more prominent than the others on the inner margin of the hand. The apices of the fingers are horny.

“The ambulatory legs are long and slender, especially the second pair; all the joints are provided with long marginal hairs. In some specimens a few spinules are met with on the anterior margin of the carpal and propodal joints, and in older specimens they appear to be represented by slight tubercular elevations. The dactyli are about one and a half times the length of the propodi.

“The following are the measurements of an adult male:—

Length of body	...	...	...	35 mm.
„ „ carapace	...	...	...	17 „
„ „ eye-stalks	...	...	...	5.5 „
„ „ chelipede	...	...	...	25 „
„ „ first leg	...	...	...	40 „
„ „ second leg	...	...	...	38 „
„ „ dactylus of second leg	...	...	...	12.5 „
„ „ propodus of same	...	...	...	7.5 „

“Some of the specimens are infested by two different Bopyrid parasites—one living in the branchial cavity, the other attached to the abdomen—but occurring in different hosts.”

Inhabiting shells of *Rostellaria delicatula* encrusted with Cirripedes and Epizoanthus, *Xenophora pallidula* encrusted with a species of *Capulus*, and *Ranella perca*. From the Bay of Bengal, off the Madras coast, 133, and 145—

250 fathoms, and from the Arabian Sea, off the Travancore coast, 224-284 fathoms.

Regd. Nos.  $\frac{4219}{7}$  :  $\frac{4223}{7}$  &  $\frac{1017-1026}{10}$  (Types of the species) :  $\frac{1027}{10}$  :  $\frac{2614}{10}$  :  $\frac{3894}{10}$ .

### CHLÆNOPAGURUS, Alcock.

*Chlænopagurus*, Alcock, Journ. Asiatic Soc. Bengal, Vol. LXVIII, pt. 2, 1899, p. 113.

Carapace quite membranous, except the gastric and cardiac regions, which are well calcified. Rostrum prominent.

The abdomen, except for the first two terga which are more or less calcified and for the last tergum and telson which are properly calcified, is a soft bag, flexed on itself but not spirally coiled, perfectly symmetrical in the male, but unsymmetrical in the female by reason of the presence on one side only of an enormous fleshy lobe that forms a brood-pouch. The tucked in telson and the hook-like caudal swimmerets are quite symmetrical, the inner swimmeret being extremely small.

The ophthalmic scales, which are spiniform, are separated by a considerable interval. The eyestalks, which are of moderate length, are stout: the eyes are large and reniform.

The antennular peduncles are of moderate length, as is the upper flagellum, which is much longer and stouter than the lower.

The antennal acicle is long: the flagellum is of fair length.

The mandibles, which carry a largish incurved three-jointed palp, have the incisor process separated from the molar process by a deep groove.

The other mouth-parts differ from those of *Parapagurus* only in the following points:—the coxopodite of the 1st maxillæ is not recedent, the scaphognathite is posteriorly truncated, the epipodite of the 1st maxillipeds is small and is not posteriorly produced, the foliaceous-falciform exopodite of the 1st maxillipeds ends in a flagellum. As in *Parapagurus*, the external maxillipeds are separated from one another at base.

The chelipeds are equal: they are massive in both sexes, but more so in the male.

The legs of the 2nd and 3rd pairs are long and stout, particularly as to the dactyli. Those of the 4th pair, though reduced in length, are longer than in most hermit-crabs and end in particularly perfect chelæ. Those of the 5th pair are short and minutely, though perfectly, chelate.

In the male the first two pairs of abdominal appendages are present and are quite symmetrical: they are uniramous appendages modified for purposes of reproduction. The appendages of the next three somites (3rd-5th) are present on one side only—right or left: they are minute, or rudimentary, and uniramous.



In the female the appendages of the first abdominal somite form a small symmetrical uniramous pair. Those of the next four somites (2nd–5th) are present on one side only—right *or* left: the first three of them are slender biramous appendages, of good size, for carrying the eggs, and are contained within a capacious cup-like brood-pouch formed by a membranous lobe that springs from one side of the fifth somite: the fourth of them is a tiny biramous appendage and is not enclosed in the brood-pouch.

In both sexes the appendages of the sixth somite are symmetrical biramous swimmerets, placed symmetrically on either side of the telson: their rami are slender and falciform.

The branchial formula is as follows:—

Somites and their appendages.	Podobranchiæ.	Arthrobranchiæ.		Pleurobranchiæ.	Total.
		Anterior.	Posterior.		
IX	0	1	1	0	= 2
X	0	1	1	0	= 2
XI	0	1	1	1	= 3
XII	0	1	1	1	= 3
XIII	0	1	1	1	= 3
XIV	0	0	0	0	= 0
Total	0	5	5	3	= 13

Each gill consists of two series of broad leaflets. The leaflets, however, are not quite simple, since each one carries, near the tip, a pair of slender filaments large enough to be seen with the naked eye.

The single species known does not inhabit a shell, but lives protected by a blanket formed by the soft fleshy coenosarc of a colony of Actiniarian polyps.

#### 10. *Chlænopagurus andersoni*, Alcock.

*Chlænopagurus andersoni*, Alcock, Journ. Asiatic Soc. Bengal, Vol. LXVIII. pt. 2, 1889, p. 115, pl. i.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATES LIII. FIGS. 1, 2 AND LIV. FIG. 1.

The cervical groove is deep-cut, and the portion of the carapace that is included within it is strongly calcified. The triangular cardiac region is also fairly well calcified, especially in its anterior part. But all the rest of the carapace, except here and there along the outer edge of the cervical groove, is quite soft and membranous. The hepatic region is marked off from the branchial region by a transverse furrow.

The front, which is carinated dorsally and deflexed at tip, projects well between the eye-stalks.

The eyes are large and reniform and are borne on stout stalks, which are about quarter the length of the carapace measured in the middle line.

The first two joints of the antennular peduncle are together about the same length as the eyestalk, the first joint being flattened and somewhat dilated

dorsally; the third joint, which is the longest, is not two-thirds the length of the upper flagellum.

The antennal peduncle is about the same length as that of the antennules: the acicle is about as long as the eyestalk: the flagellum is about twice the length of the carapace.

The chelipeds are massive, quite equal, and about as long as the entire body with the abdomen flexed in the natural position: not much more than a third of their length is formed by the merus, which is slightly shorter than the hand. They are more or less covered with long, stiff, golden yellow bristles, which are specially thick-set on the under surface of the merus and the outer surface of the wrist and hand: these bristles do not hide the rather coarse squamiform tubercles from which they spring. There are some coarsish spines along the inner border of the ischium, both the lower borders of the merus, and on a good part of the outer surface of the wrist and hand. The fingers are spooned and have corneous tips.

The legs are stout and compressed, and their borders—and in the case of the last three joints of the first two pairs, a considerable part of the surface also—are more or less covered with stiff yellow bristles like those that grow on the chelipeds. The first pair of legs are of equal length with the chelipeds. The second pair are a little longer, and a third of their length is formed by the long sabre-shaped dactylus. The third pair do not reach to the far end of the carpus of the second pair: they terminate in a very perfect chela of comparatively large size, with the dactylus anterior (or dorsal). The fourth pair reach just beyond the far end of the merus of the third pair: they end in a very much smaller and less perfect chela, with the dactylus posterior (or ventral).

The abdomen is a perfectly soft membranous bag, of which the segmentation is quite recognizably, but far from conspicuously, defined. In the male it is symmetrical, though the minute or rudimentary appendages, that are present on one side (right *or* left) of the 3rd, 4th and 5th segments, are represented on the other side only by small tufts of small bristles. In the female its symmetry is lost by the presence, on one side or other, of a large membranous leaf-like lobe that forms a capacious cup-like brood-pouch.

The first two pairs of abdominal appendages of the male end in convoluted plates, the second pair working in the grooves formed by the first pair.

The telson is quite symmetrical, and lies in the middle line, tucked up against the ventral surface of the abdomen. On either side of it are the quite symmetrical swimmerets of the sixth pair: the basipodite of these has a spine at its posterior angle: both the exopodite and endopodite are narrow slender and falciform, with the anterior edge serrated and the tip spiniform: the exopodite is many times larger than the endopodite.

The animal does not inhabit a shell, but is protected by the soft fleshy coenosarc of a colony of Actiniarian polyps. This forms a sort of sheet or blanket, one end of which is tucked round the telson of the crab and is firmly held by the hook-like swimmerets of the 6th abdominal somite and by the folded-in telson, while the corners of the other end are firmly grasped by the chelæ of the penultimate thoracic appendages in such a way that the sheet can be drawn right over the back of the crab as far as the eyes.

The colour of the crab is red: the coenosarc of the polyp-colony is bluish, the polyps themselves are dark purple.

A large male, lying in the natural position with the telson bent under, measures, from the tip of the rostrum, 63 millim.; and the chelipeds of the same individual, measured along their convex curve, are 68 millim. in length.

An egg-laden female measured in the same way, is 37 millim. long and has chelipeds 35 millim. long.

205 specimens, representing both sexes in all stages, were dredged by the Investigator off Cape Comorin, in 102 fathoms.

Regd. Nos.  $\frac{3534-3537}{10}$  (Types of the species):  $\frac{3169-3189}{10}$ .

### LITHODEA, Henderson.

*Lithodea*, Henderson, Challenger Anomura, p. 41 (*et synonym.*).  
*Lithodinés*, Bouvier, Ann. Sci. Nat., Zool. (8) 1. 1896, p. 1.

Carapace uniformly well calcified, crab-shaped, having sharply defined lateral borders, its regions well defined: a spiniform rostrum is present and conceals the ophthalmic somite. Thoracic sternum broad.

Abdomen broadly triangular, tightly flexed against the thoracic sternum, as in crabs: it consists of 7 segments, of which the first 2 form, dorsally, a single undivided plate while the next three (3-5) consist of two lateral and a median series of plates. Caudal swimmerets are never represented.

The first 4 pairs of thoracic legs are well developed, the 4th pair being at least as long as any of the others; but the 5th pair are short slender and weak, and are folded within the branchial chambers. The first pair are chelate.

Abdominal appendages are present in the female only, as a rudimentary pair on the 1st somite and as rudiments only on one side of the next four somites.

A single family—*Lithodidæ*.

#### Key to the genera of *Lithodidæ* of the Indian Oligobenthos.

- |     |  |     |     |     |     |            |
|-----|--|-----|-----|-----|-----|------------|
| I.  | The median portion of the 3rd-5th abdominal somites is covered with small calcareous platelets | ... | ... | ... | ... | LITHODES.  |
| II. | The median portion of the 3rd-5th abdominal somites consist of large calcareous plates         | ... | ... | ... | ... | PARALOMIS. |

## LITHODES, Latreille.

*Lithodes*, Latreille; Henderson, Challenger Anomura, p. 42 (and references).

Rostrum long, horizontal, and spinose: a spine on either side of it at the antero-lateral angle of the carapace forms a sort of orbit, by accenting the orbital notch.

The median portion of the 3rd-5th abdominal somites is membranous and covered with small calcareous platelets: in the female the lateral plates of these somites are very much larger on the left side than on the right.

The outer angle of the 2nd joint of the antennal peduncle is produced to form a spine, inside of which, in the Indian species, there is no large acicle.

11. *Lithodes agassizii*, S. I. Smith.

*Lithodes agassizii*, S. I. Smith, Bull. Mns. Comp. Zool. X. 1882, p. 8, pl. i: Henderson, Challenger Anomura, p. 42: Anderson, J.A.S.B., LXV. pt. 2, 1896.

A single small specimen, which is undoubtedly the young of this species, was dredged off the Cochin (Malabar) coast in 406 fathoms. The spines of the carapace and rostrum are of enormous length.

Regd. No.  $\frac{127}{10}$ .

## PARALOMIS, White.

*Paralomis*, White; Henderson, Challenger Anomura, p. 44 (and references).

Rostrum three-pronged, a spine on either side of it accents the orbital notch.

In the 3rd-5th abdominal somites the median plates are large and the lateral plates subequal in both sexes.

The outer angle of the 2nd joint of the antennal peduncle is produced to form a spine, inside of which is a large spinose movable antennal acicle.

The molar and incisor processes of the mandible are separated by a deep groove: the mandibular palp is large and 3-jointed. The 1st maxillæ have a simple palp. In the 2nd maxillæ the coxa and basis are transversely fissured, and the large scaphognathite is posteriorly truncated. All three pairs of maxillipeds have flagellate exopodites, but no epipodites. The external maxillipeds are stoutly pediform and six-jointed, the basis and ischium being fused.

The gills, which are phyllobranchiæ, are 11 on either side, namely 5 pairs of arthrobranchiæ (somites IX-XIII) and a single pleurobranch (somite XIII).



*Key to the Indian species of Paralomis.*

- I. Carapace very closely covered with small tubercles which are all of one size and are all crowned with short stiff setæ. Rostrum trifold with the sides and dorsum spiny ... .. *P. investigatoris.*
- II. Carapace covered with non-setose tubercles of several sizes. Rostrum trifold with a pair of denticles at base ... .. *P. indica.*

12. *Paralomis investigatoris*, Alcock & Anderson.

*Paralomis investigatoris*, Alcock and Anderson, Ann. Mag. Nat. Hist., Jan. 1899, p. 17.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLIII, FIG. 1.

This appears to be most nearly related to the *Paralomis aspera* of Faxon, from off the Pacific coast of Panama.

Carapace piriform, convex, slightly longer than broad; gastric, cardiac, and branchial regions well defined, tumid; the entire surface of the carapace, as of the second abdominal segment, is closely covered with equal-sized papilliform tubercles, each of which is encircled by a crown of small stiff hairs.

Rostrum very distinctly and evenly trifold, the middle spine with a few minute denticles at the proximal end of its ventral border; its sides and dorsal surface are spinate.

Lateral margins of carapace, from the spiniform orbital angle to the middle of the branchial regions, armed with sharp curved spines.

Eye-stalks dorsally spinulose. Antennulary peduncle smooth. Antennal peduncle with the first two joints spiniform at the outer angle and the third joint spiniform at the inner angle, the flagellum longer than the carapace.

The movable antennal acicle reaches nearly to the end of the peduncle and ends very acutely; its outer edge bears at least three large spines and its inner edge three small spines.

Chelipeds and legs thickly spiny, especially on the dorsal surfaces. The right cheliped is very slightly stouter than the left, which is not stouter than the legs; but the right legs are not longer than the left. The legs all end in a little black claw and are hardly half a dactylus longer than the chelipeds; they are about  $1\frac{2}{3}$  times the length of the carapace.

The second abdominal segment bears a single dorsal plate, which is rather deeply dimpled on either side of the middle line.

The abdomen of the male is quite straight and practically symmetrical; in the female it is not quite symmetrical and is slightly twisted to the right.

Four specimens, the largest of which has the carapace 33 millim. long and 29.5 millim. broad, from off the Travancore coast, 430 fathoms.

Colours in spirit orange, eyes intensely black.

Regd. No.  $\frac{2383-2386}{10}$  (Types of the species).

### 13. *Paralomis indica*, Alcock and Anderson.

*Paralomis indica*, Alcock and Anderson, Ann. Mag. Nat. Hist., Jan. 1899, p. 15.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLIII, FIG. 2.

Differs from *P. verrucosa* in the following respects:—

The antero-lateral and lateral borders of the carapace are more irregularly and much more acutely spiny.

The abdomen, behind the second segment, has its dorsal surface somewhat creased, but not tuberculous.

The eyes are relatively much larger.

The movable antennal acicle has only two spines, one of which is small, on its outer border; the antennary flagella are nearly as long as the carapace.

The chelipeds and legs are relatively longer and slenderer; the wrist is longer and its inner angle does not form a foliaceous lobe.

Carpace piriform, convex, very slightly longer than broad; gastric, cardiac, and branchial regions well defined, the gastric and branchial tumid and prominent, the cardiac, though convex, a good deal sunken. The surface of the carapace, as of the second abdominal segment, is studded with vesiculous, pustulous, and conical tubercles of various sizes.

Rostrum very distinctly and evenly trifold and having a denticle on either side near the base.

Lateral margins of carapace, from the spiniform orbital angle to the posterior border, armed with spines of various sizes; posterior border armed with conical tubercles of uniform size.

Eye-stalks with a few denticles dorsally. Antennular peduncles smooth. Antennal peduncle with the first two joints spiniform at the outer angle, the flagellum about as long as the carapace.

The movable antennal acicle, which reaches slightly beyond the end of the antennal peduncle, ends very acutely; its outer edge bears a spinule and a large spine, its inner edge bears three small spines.

Chelipeds and legs spiny, especially on the dorsal surfaces. The right cheliped is distinctly stouter, and the right legs are distinctly longer, than the left. The legs, which are nearly a dactylus longer than the chelipeds and rather less massive than the left cheliped, are about  $1\frac{2}{3}$  times the length of the carapace.

The second abdominal segment consists of a single plate dorsally, which is dimpled on either side of the middle line.

The abdomen of the male has a slight twist to the right and is nearly symmetrically constituted; in the female, although it is unsymmetrical, it is not much more twisted.

Four specimens, the largest of which has the carapace 39.5 millim. long and 37 millim. broad, were taken off the Travancore coast at 430 fathoms.

Colours in spirit pale milky orange-pink, eyes intensely black.

Regd. No.  $\frac{2380-2382}{10}$  (Types of the species).

### GALATHEIDEA Henderson.

*Galatheidæ*, BOAS. Vid. Selsk. Skr., 6 Raekke, Nat. og. Math. Afd. I. 2. 1880, p. 195.

*Galatheidea*, Henderson, Challenger Anomura, p. 103, (et syn.): Ortmann in Bronn's Thier Reich, Malacostraca, p. 1148.

*Galathéidés*, Milne Edwards and Bouvier, Ann. Sci. Nat. Zool. (7) XVI. 1894, p. 191 et seq., and Mem. Mus. Comp. Zool. XIX. 2. 1897, p. 12, and Crust. Decap. Hirondelle et Princesse Alice, Monaco, 1899, p. 70.

Carapace generally more or less depressed, commonly elongate, sometimes broad and crablike, the front not fused with the epistome: the rostrum is well developed and conceals the ophthalmic somite. Thoracic sternum broad.

The abdomen is broad well-calcified and symmetrical and ends in a broad symmetrical tail-fan formed of a broad telson and foliaceous caudal swimmerets: it is either folded on itself, or flexed against the thoracic sternum.

Antennal peduncle often four-jointed (the 2nd and 3rd joints having fused), the 2nd joint only occasionally carries a movable acicle.

The flagella of the maxillipeds, when present, are flexed inwards, and though in the deep-sea forms the external maxillipeds are generally pediform, in some littoral forms they are opercular.

The 1st pair of thoracic legs are massive and chelate, the next 3 pairs are all monodactylous and all about equally well developed, the 5th pair, which may be subchelate or minutely chelate, are weak and flexed.

It is usual but not universal to find, in the male, paired appendages modified for copulation, on the first 2 abdominal somites, and paired appendages (which are commonly more or less rudimentary) on the next 2 or 3 somites, and, in the female, paired appendages on the 2nd-5th somites.

Henderson divides the *Galatheidea* into two groups—the Brachyura-like PORCELLANOIDEA, which, in these seas, are, so far as our present knowledge goes, inhabitants of the rocks and reefs of the littoral zone, and the Macrura-like GALATHOIDEA, which are abundantly represented in the depths.

A. Milne Edwards and Bouvier (Ann. Sci. Nat., Zool., (7) XVI. 1894) include all the *Galatheidea* in one family, *Galathéidés*, which they subdivide into

3 subfamilies, *Galatheinés* (including Henderson's *Porcellanodea*), *Diptycinés*, and *Aegléinés* (for the S. American freshwater form *Aeglea*).

Ortmann adopts the group *Galatheidea*, which following Milne Edwards and Bouvier he divides into 4 sections which he ranks as families, *Aeglaeidae*, *Chirostylidae* (= *Diptycinés* of Milne Edwards and Bouvier), *Galatheidae*, and *Porcellanidae*, which seems to me to be a very sensible course, and it is followed here.

Only two of Ortmann's families, the *Galatheidae* and the *Uroptychidae* (= *Chirostylidae*) are, so far as is known, represented in the depths of these seas; the following is a synopsis of their distinctive characters.

*Synopsis of the families of Galatheidea of the Indian Benthos and Oligobenthos.*

- I. The telson, which is not folded beneath the preceding abdominal somites, is distinctly made up of plates which suggest a tergum and a pair of appendages modified: the last thoracic sternum is narrow, but well formed: the antennal peduncle appears to be four-jointed, the 2nd and 3rd joints being united: the incisor edge of the mandible is entire: a foliaceous epipodite is present on the 1st maxillipeds, and a flagelliform epipodite is almost always present on the external maxillipeds ... GALATHEIDÆ.
- II. The telson, which is transversely fissured, is, along with the caudal swimmerets, folded beneath the preceding abdominal somites: the last thoracic sternum is more or less atrophied: the antennal peduncle is five-jointed, the 3rd joint being quite distinct from the 2nd: the incisor edge of the mandible is serrated: no epipodites on any of the maxillipeds ... UROPTYCHIDÆ.

Family *Galatheidae*, Dana.

*Galatheidae*, Dana, U. S. Expl. Exp., pt. II, p. 1431: Henderson Challenger Anomura, p. 116 (part): Stebbing, Hist. Crust. p. 175 (part): Ortmann in Bronn's Thier Reich Malacostraca, p. 1150:

*Galathéens*, Milne Edwards and Bouvier, Ann. Sci. Nat., Zool. (7) XVI. 1894, pp. 245, 312-313.

Carapace longer than broad, with the lateral borders well defined and the antero-lateral angles accented, its dorsum usually ornamented with transverse ridges or squamous tubercles, the regions usually well defined. Thoracic sternum broad, the independent last segment being distinct.

Rostrum well developed.

Abdomen simply folded on itself at the level of the 4th and 5th somites, the large symmetrical tail-fan not being in any way tucked up or concealed beneath the preceding somites. The 1st somite is almost completely hidden beneath the carapace. The pleura behind the 1st somite are well developed.

Eyestalks short: no orbits. Antennular peduncle loosely flexed, but not in any way concealed by fossæ, the basal joint, though shorter and much broader



than any of the others, is not widely dilated: the flagella are short, especially the lower one.

Antennal peduncle 4-jointed, owing to the fusion of the true 2nd and 3rd joints: the flagellum long.

The incisor edge of the mandible is entire.

Of the maxillipeds the 1st pair have a foliaceous epipodite and the 3rd external) pair a flagelliform epipodite.

The chelipeds and next 3 pairs of legs are well developed, but the last pair of legs are flexed and weak.

In the abdomen paired appendages are usually present on all the somites (except occasionally the 1st) in the male, and on all except the 1st in the female.

*Key to the genera of Galatheidæ of the Indian Benthos.*

- I. Integument crisp. The exopodite of the 1st maxillipeds terminates in a flagellum. Eyes faceted and well-pigmented:—
1. Rostrum triangular with serrated edges ... .. GALATHEA.
  2. Rostrum acutely styliform, flanked on either side by a long acicular supraorbital spine ... .. MUNIDA.
- II. Integument thick, coarse, and very strongly calcified. The exopodite of the 1st maxillipeds does not end in a flagellum. Eyes opaque, non-faceted and non-pigmented:—
1. Rostrum horizontal: no gigantic spine in the middle of the gastric region ... .. MUNIDOPSIS.
  2. The rostrum consists of a horizontal basal portion and an abruptly upstanding distal portion: there is a gigantic median spine on the gastric region ... .. GALACANTHA.

Two very small specimens of two species of *Galathea* have been dredged in the Andaman Sea at 120 and 405 fathoms. It is quite impossible to identify them.

MUNIDA, Leach.

*Munida*, Leach; Henderson, Challenger Anomura, p. 123 (and references): A. Milne Edwards and Bouvier Ann. Sci. Nat. Zool. (7) XVI. 1894, p. 253, and Mem. Mus. Comp. Zool., XIX. No. 2, 1897, p. 20 (and references).

Carapace longer than broad, the transverse lines well developed and ciliated, the antero-lateral borders spinose, the cardiac area usually well defined. Thoracic sternum broad.

Rostrum slender and styliform, flanked on either side by an acicular supra-orbital spine.

Abdomen simply flexed, the terga usually with transverse sculpture: the

pleura behind the 1st are fairly well developed and commonly have some concentric sculpture. Tail-fan large and symmetrical, the telson being particularly broad and having some squamose sculpture.

Eyes generally large and well pigmented. Antennular peduncles weak and flexed, the flagella short, especially the lower one.

Antennal peduncle 4-jointed, the distal angles of the 2nd (=2nd + 3rd) joint spiniform: the flagellum long.

Mandible with 3-jointed incurved palp, and with the narrow molar process well separated from the trenchant (non-serrate) incisor process. Maxillæ with the coxa and basis well developed: the 1st maxilla with a short palp, the 2nd maxilla with the coxa and basis deeply cleft transversely and with a broad posteriorly-acute scaphognathite.

The exopodites of all three pairs of maxillipeds end in a flagellum, that of the 1st maxillipeds being short.

The 1st maxillipeds have a foliaceous angular epipodite which is directed forwards or outwards, and the external maxillipeds have a slender epipodite, but there are no epipodites on the legs.

The chelipeds and next three pairs of legs are long and slender, the chelipeds being longer and more massive than the legs. The last pair of legs, which are weak and are minutely chelate, are folded.

In the male paired appendages, modified for copulation, are present on the 2nd abdominal somite and usually on the 1st also, and small foliaceous paired appendages (which may be rudimentary) are present on somites 3-5. In the female slender paired appendages are present on somites 2-5.

The branchiæ, which are phyllobranchiæ, are 14 on either side, namely 5 pairs of arthrobranchiæ (somites IX-XIII) and 4 pleurobranchiæ (somites XI-XIV).

The eggs are small and rather numerous.

#### *Key to the Indian species of Munida.*

- I. None of the abdominal terga are armed with spines. The posterior border of the carapace is smooth. The eyes are not dilated. The 1st abdominal somite of the male carries a pair of appendages ... *M. comorina.*
- II. The 2nd abdominal tergum only has a row of spines on its anterior border. Posterior border of carapace smooth. Male with a pair of appendages on the 1st abdominal somite:—
  1. Eyes small, not wider than their stalks:—
    - i. The chelipeds of the male are not more than twice the length of the body ... .. *M. microps.*

- ii. The chelipeds of the male are more than twice the length of the body ... .. *M. microps* var. *lasiocheles*.
2. Eyes very large, their major diameter being about one-fourth the length of the carapace proper. The chelipeds of the male may be nearly as long as the body (though occasionally they are half again as long as the body) ... .. *M. andamanica*.
- III. The 2nd abdominal tergum has a row of spines on its anterior border, and the 3rd tergum also may have a pair of spines on this border. Posterior border of carapace smooth. Male with a pair of appendages on the 1st abdominal somite. Eyes very large. Chelipeds in both sexes much longer than the body ... .. *M. vigiliarum*.
- IV. The 2nd 3rd and 4th abdominal terga are armed with spines, as is the posterior border of the carapace. The eyes are very large. The 1st abdominal somite of the male is destitute of appendages:—
1. The 2nd and 3rd abdominal terga have each a single row of spines. The inner angle of the basal joint of the antennal peduncle is spiniform but not greatly produced ... .. *M. squamosa*.
2. The 2nd and 3rd abdominal terga are armed each with two rows of spines. The inner angle of the basal joint of the antennal peduncle is produced into a stout curved spine half as long as the carapace ... .. *M. tricarinata*.

#### 14. *Munida comorina*, Alcock and Anderson.

*Munida comorina*, Alcock and Anderson, Ann. Mag. Nat. Hist., Jan. 1899, p. 18.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLIII. FIG. 3.

Seems hardly to differ from the Caribbean *Munida caribæa*, A. M.-Edw. (which Faxon says is the same as *M. irusa*, A. M.-Edw.), having, like it, a long denticulated rostrum, no cardiac spine, and a smooth abdomen.

Dorsal surface of carapace transversely striated and bearing eight spinules, namely a pair behind each supraocular spine, one on either side behind and external to the first pair, and one on either side just beyond the bifurcation of the cervical groove; but all these spines need careful looking for with a lens.

Rostrum well over half the length of the rest of the carapace and about three times as long as supraocular spines (and, like them, acicular), finely and obscurely denticulated in its distal half.

Abdomen perfectly smooth.

The two spines on the dilated portion of the antennular peduncle are long and slender. Eye-stalks barrel-shaped, eyes not reniform.

Chelipeds slender, twice the length of the fully extended body and rostrum, and twice the length of the longest legs; distant spines along the inner aspects of the arm and wrist, and distant spinules along the inner border of the hand;

fingers straight, but in some males the fixed finger is excavated and slightly bent at base for the reception of one or two enlarged teeth of the dactylus.

The fully extended body is only 15 millim. long.

Arabian Sea, off the Travancore coast, 430 and 459 fathoms.

Regd. Nos.  $\frac{1937-1939}{10}$  :  $\frac{2315-2329}{10}$  (Types of the species) :  $\frac{1373-1377}{10}$ .

### 15. *Munida microps*, Alcock.

*Munida microps*, Alcock, Ann. Mag. Nat. Hist., April 1894, p. 326.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XIII. FIG. 5.

Very closely related to *M. microphthalma*, A. M.-Edw.

The breadth of the carapace is barely three-fourths of the length (without the rostrum). The rostrum, which is strongly upcurved and is indistinctly serrated at tip, is considerably more than half the length of the carapace and considerably more than double the length of the divergent supraorbital spines; it extends backwards as a faint carination of the anterior third of the gastric region. The frontal border on either side of the rostrum is convex and slightly oblique; the posterior border is raised but unarmed; the lateral margins are armed with 7 (2 + 3 + 2) spines. The transverse ridges are strongly developed, smooth, and thickly fringed with short setæ. The tumid gastric area bears in front a convex row of spines, only two of which, namely, those which stand immediately behind the supraorbital spines, are conspicuous, the outermost spine on each side being placed far back on a level with the centre of the hepatic region. The cardiac area is well defined and is bounded on each side by a spine standing immediately behind the bifurcation of the cervical groove. A spinule or two are found within the area enclosed by the bifurcation of the cervical groove.

Abdominal terga each with one or two smooth setose ridges; the second tergum only is armed, having 6 to 8 spines on its front edge.

The eyes are small, cinnamon-coloured, hardly compressed and little dilated, their major diameter being about one-eighth the length of the carapace.

The spines of the basal joint of the antennular peduncle are long and needle-like.

The antennal peduncles are smooth; the basal joint has its internal angle produced into a stout spine, which, however, is not visible from above, and the second joint has both its anterior angles produced into long acicles; the flagellum is of great length.

The external maxillipeds are slender, almost smooth, and but slightly hairy; the inner edge of the ischium is sharply toothed throughout and the inner edge of the merus near the proximal end bears a very prominent spine.



The thoracic legs are slender, smooth or very faintly squamous and very slightly hairy. The chelipeds vary in length in the male (in which sex they are not quite equal) from one and a half times to twice the length of the fully extended body: in the female they are between one and a third and one and a half times the length of the body: the merus and carpus, and the propodite in its palmar portion are covered with large thorns; the fingers, which do not quite equal the palm in length, are evenly and finely toothed, and the fixed finger has also several distant spines along its outer margin, and at the base of the terminal claw a pair of small teeth, between which the tip of the dactylus closes.

Of the second, third, and fourth thoracic legs the merus has both its margins and the carpus its front margin thorny, the posterior margin of the carpus having only a long terminal spine, while the propodite and dactylus have their posterior edge serrated for a series of minute articulating spinules.

The first pair of abdominal legs in the male have the usual development.

Colour in life milky pink.

In the largest male the length of the body is 45 millim., and that of the longer cheliped 87 millim.

Andaman Sea, 480, 490, 561 and 640 fathoms: Arabian Sea, off the Travancore and Ceylon coasts, 459 and 675 fathoms.

Regd. Nos.  $\frac{6894-6895}{9}$  (Types of the species):  $\frac{51}{7}$ :  $\frac{119-130}{7}$ :  $\frac{524-525}{7}$ :  $\frac{8759-8760}{9}$ :  $\frac{1371-1372}{10}$ :  $\frac{1719-1720}{10}$ .

*Munida microps* var. *lasiocheles*, Alcock.

*Munida microps* var. *lasiocheles*, Alcock, Ann. Mag. Nat. Hist., April 1894, p. 327.  
ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XIII. FIG. 8.

Differs from *M. microps* only in the structure of the chelipeds, which (in the male) are markedly unequal, one (the right in one individual, the left in the other) exceeding its fellow by nearly the whole length of the dactylus, both being much longer than in typical *M. microps*.

The chelipeds are very densely furred, except on the short ischium, and are from nearly twice to two and a half times the length of the fully extended body measured with the rostrum; they are thorny, much as in *M. microps*, except that the thorns are relatively smaller, especially on the propodite, and most of all on the propodite of the larger cheliped, where they are almost entirely hidden in the thick fur. The fingers are not much more than half the length of the palm; and while in the smaller claw they are straight, closely apposed, and otherwise the same as in *M. microps*, in the larger claw they are separated throughout, but especially at the base, where there is found on the dactylus a large truncated

tubercle and on the fixed finger a corresponding excavation and bulging. The carpus of the shorter claw has a strong bend outwards.

Two males were dredged in the Andaman Sea, along with *M. microps*, at 480 fathoms. The largest measures 60 millim. from the tip of the rostrum to the end of the telson, its longer cheliped measuring 142 millim.

They are probably merely dimorphic males of *M. microps*. Similar instances of dimorphism in the males of *Munida* have been noticed by Henderson, A. Milne Edwards, and E. Bouvier.

Regd. Nos.  $\frac{132-133}{7}$  (Types).

### 16. *Munida andamanica*, Alcock.

*Munida militaris* var. *andamanica*, Alcock, Ann. Mag. Nat. Hist., April 1894, p. 321.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XIII. FIG. 2.

But for the short chelipeds this species closely resembles the Atlantic *M. iris*, A. M. Edw.

The length of the carapace is very little more than its greatest breadth. The uptilted rostrum is a good deal more than half the length of the carapace and more than double the length of the slightly divergent supraorbital spines; it extends backwards as a faint carination of the front half of the gastric region. The anterior border of the carapace on either side of the rostrum is convex and slightly oblique; the posterior border is smooth; the lateral borders are armed with 7 (2 + 3 + 2) spines. The transverse ridges are strongly developed and finely and faintly beaded, and are thickly fringed with setæ, some of which at regular distant intervals are long. The gastric area is armed in front with a convex row of spines, of which only two, namely those in the immediate rear of the supraorbital spines, are conspicuous, while of the others the outermost one on each side is the largest and stands far back.

A small spinelet is present on each side immediately behind the bifurcation of the cervical groove. The cardiac area is usually well defined by a zigzag incision.

The abdominal terga have the transverse ridges well developed and setose; the second only is armed, having on its anterior margin a row of 8 distant spinelets.

The eyes are large, the major diameter being between one-third and one-fourth the length of the carapace; conspicuous setæ fringe them and the pigmentation varies from slate-grey to cinnamon-brown.

The spines of the basal joint of the antennular peduncles are long and needle-like.

The antennal peduncles are smooth; the basal joint has its antero-internal angle produced into a spine which is not visible from above, and the second joint

has both its anterior angles produced into long sharp spines; the flagellum is about three times the length of the body.

Of the external maxillipeds the ischium has its inner edge finely, sharply, and very regularly toothed throughout, and the meropodite has two large spines on its inner edge.

The thoracic legs are comparatively short and stout. The chelipeds when fully extended only just exceed the fully extended body in length without the rostrum in the male, and in the female only just equal the body without the rostrum, and from the ischium outwards they are hairy and granular; the prismatic meropodite has the upper edge spiny throughout and the inner edge spiny in its distal half, and ends above in two huge spines, the inner edge and the granular outer edge ending in smaller spines; the carpus has spines in two rows on its upper and outer surface and two or three obliquely placed spinules on its inner surface; the propodite in the upper and outer surface of its palmar portion has three rows of spines; the fingers are rather longer than the palm and are closely and evenly toothed, the fixed finger having usually a large spine near the middle of its outer edge and terminating in a pair of large spines, between which the tip of the dactylopedite closes.

Of the second, third, and fourth thoracic legs the upper (anterior) edge is closely fringed with long hairs from the base of the ischium to the tip of the claw; in all the merus and the carpus have the upper (anterior) edge strongly spined, and the merus, propodite, and dactylus have the posterior edge serrate or spinulate.

The largest male measures 54 millim. and the largest female 56 millim. from the tip of the rostrum to the end of the telson.

Colours in life: cephalothoracic region and appendages pink, abdominal region white.

The characters are quite constant throughout a large series of individuals of both sexes.

From the Andaman Sea, 173, 198, 130-248, 240, 250, 270, 238-290, 295-360, 370-419, and 405 fathoms; and from the Arabian Sea, in the neighbourhood of the Laccadives and Maldives, 210 and 295-360 fathoms.

There is a single large male in the collection in which the rostrum is less than half the length of the carapace proper and the chelipeds are half as long again as the fully extended body.

Regd. Nos.  $\frac{6896-6900}{9}$  (Types of the species):  $\frac{9152}{6}$ :  $\frac{9932}{6}$ :  $\frac{15}{7}$ :  $\frac{19}{7}$ :  $\frac{514}{7}$ :  $\frac{548-549}{7}$   
 $\frac{3190}{9}$ :  $\frac{8756-8758}{9}$ :  $\frac{1357-1361}{10}$ :  $\frac{1381}{10}$ :  $\frac{2609-2611}{10}$ :  $\frac{3758}{10}$ .

### 17. *Munida vigiliarum*, n. sp.

Carapace a good deal longer than broad. Rostrum not half the length of



the rest of the carapace, more than twice the length of the supraorbital spines. Antero-lateral borders of carapace with 7 spines. No spines on dorsum of carapace except a curved transverse row immediately behind the rostrum, and a spine on either side behind the bifurcation of the cervical groove. Posterior border of carapace quite smooth. All the transverse ridges well developed and ciliated. Cardiac area ill-defined.

2nd abdominal tergum with a row of spinules on the anterior border: a pair of minute spinules is sometimes present on the same border of the 3rd tergum: the other terga are unarmed.

In the external maxillipeds the distal end of the ventral border of the ischium is produced to an acicular spine, and there is a similar spine of equal size on the same border of the merus.

The eyes are large, their major diameter being more than a fourth the length of the carapace proper.

The chelipeds in the male are about  $1\frac{2}{3}$  times, in the female about  $1\frac{1}{4}$  times the entire length of the body: all the joints including the dactylus are spiny. The 2nd pair of legs which are the longest are a little longer than the body, reaching just beyond the base of the palm of the male and more than two-thirds of the way along the palm in the female. In all the legs of the 2nd-4th pairs both borders of the merus and the anterior border of the carpus are spiny, the posterior border of the carpus terminates in a spine, and the posterior border of the propodite is armed with a series of fine articulating spinelets.

The dimensions of a male are as follows:—length from tip of rostrum to end of extended telson 23 millim., length of cheliped, 37 millim. In a female of the same length the chelipeds are 29 millim. long.

Bay of Bengal off the west coast of the Andamans in the neighbourhood of the Sentinel Is., 173, 240, 270 and 238-290 fathoms.

This species is very closely related to the Mediterranean and Atlantic species *M. bamffica*.

Regd. Nos.  $\frac{9931}{6} : \frac{16}{7} : \frac{515}{7} : \frac{547}{7}$  (Types of the species).

### 18. *Munida squamosa*, Hndrsn. var. *prolixa*, Alc.

*Munida squamosa* var. *prolixa*, Alcock, Ann. Mag. Nat. Hist., April 1894, p. 322.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XIII. FIG. 3.

The length and the greatest breadth of the carapace are nearly the same. The almost horizontal rostrum is one-third the length of the carapace, and the orbital spines, which are slightly inclined upwards, are two-thirds the length of the rostrum,—all three being very distinctly squamous. The anterior margin of the carapace on either side of the rostrum is concave and without any



obliquity ; the posterior margin has a pair of spines, one on either side of the middle line ; the lateral margins are armed each with five spines. The gastric area is very distinctly delimited and is armed in front with two (and only two) spines, which stand immediately behind the supraorbitals and are about a third the length of these. The cardiac area also is very distinctly defined, and is surmounted centrally by a large spine and flanked on each side, just behind the bifurcation of the cervical groove, by a similar spine. The transverse ridges are well developed and are strongly and sharply beaded and thickly and very finely setose.

The abdominal terga also are most beautifully sculptured with similar ridges, transverse and concentric ; the second, third and fourth terga are armed on their anterior margin each with four distant spines, the middle pair of which are large and conspicuous, and the fourth also has in its hinder portion and in the middle line a single spine.

The eyes are large, their major diameter being more than one-fourth the length of the carapace, and the eye-stalks on the upper surface have several setose squames ; the corneal region is compressed and closely fringed with setæ at base.

The spines on the basal joint of the antennules are not large, only the outer terminal spine and the anterior of the two marginal spines being of noticeable size.

The antennal peduncles are scaly ; the basal joint has a small tubercle at its internal angle, and the second and the third joints have each a spine in the same situation ; the flagellum is very little longer than the chelipeds.

The external maxillipeds are very hairy and have the exposed surface of the ischium and merus scaly, the former joint being serrated, up to a large terminal spine, along the inner edge, and the latter having a similar spine near the middle of the inner edge.

The thoracic legs are long, slender, and most remarkably squamous, the scales being fringed with fine setæ. The chelipeds, which are relatively both stouter and longer in the male, are in that sex one-third of their own extent longer than the body with the rostrum, being also a little unequal ; the merus, which is almost square in transverse section, has three regular rows of spines on its upper and inner face ; and the carpus and propodite, which are almost cylindrical, have each two irregular rows of spines on the inner face, the propodite also having two or three spines on the outer aspect ; the fingers are about two-thirds the length of the palm and are finely toothed, the fixed finger having a second series of 5 or 6 large teeth and ending in a pair of claw-like spines, between which the tip of the dactylus shuts.

Of the second, third, and fourth thoracic legs the merus has both edges spiny, the anterior the more markedly so ; the carpus has the anterior edge

spiny, the posterior edge having only a single terminal spine; the propodite has the posterior edge distantly spinulate; and the dactylus has the anterior edge crenulate.

The first abdominal appendages are absent in the male.

Colour in life dull red.

A male 54 millim. long has the larger cheliped 87 millim. in length.

Andaman Sea, 130, 185, 188-220, 194, and 240 fathoms. Arabian Sea, off Ceylon, 142-400 and 180-217 fathoms.

This species is very closely related to the Atlantic and Mediterranean *M. tenuimana*.

Regd. Nos.  $\frac{6892-6893}{9}$  (Types of the species):  $\frac{9153}{6}$ :  $\frac{147}{7}$ :  $\frac{8762-8780}{9}$ :  $\frac{770-773}{10}$ :  
 $\frac{2332-2337}{10}$ :  $\frac{2607-2608}{10}$ .

### 19. *Munida tricarinata*, Alcock.

*Munida tricarinata*, Alcock, Ann. Mag. Nat. Hist., April 1894, p. 324.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XII. FIG. 1.

Belonging to the group *Munida granulata*, *scabra*, and *proxima*, Henderson, and *Munida obesa*, Faxon.

The length of the carapace and the greatest breadth are equal. The entire carapace is covered with spinelets arranged in longitudinal and transverse rows. The rostrum is less than one-fourth the length of the rest of the carapace and not very much longer than the supraorbital spines; it is continued backwards to the after border of the carapace, first as a sharply spinulate carination of the front half of the gastric region, then as a row of 3 close-set spines traversing the posterior half of the gastric region, then as a row of 3 more distant spines traversing the cardiac region, and terminates as a large spine on the posterior margin of the carapace. On either side of this rostral series of spines the orbital spine also is continued backwards as a gently divergent series of rather smaller spines, so that the carapace is longitudinally traversed by three sharply spinate carinæ. The anterior margin on either side of the rostrum is concave, without any obliquity; the posterior margin is raised and closely spinate throughout; on the lateral margins the spinature is hardly to be distinguished from the general spinature of the surface, the antero-lateral spine alone being large.

Abdominal terga with the transverse and concentric ridges well developed; the first tergum is remarkably broadly exposed and has the entire surface sharply rugose; the second and third have their anterior edge and their principal transverse ridge spinate, two of the spines in every case, namely, those on either side of the middle line, being large; the fourth has the anterior edge only armed in an exactly similar manner.

The eyes are large—the major diameter one-fourth the length of the carapace—and much compressed; the corneal region is remarkably narrow and the setæ that fringe its basal margin overlap the eye in front; in addition to these setæ there are three half-rings of setæ on the eye-stalks.

The basal joint of the antennal peduncle has its antero-internal angle produced into a great serrated hairy spine about half as long as the carapace, the spines of the two sides converging in front of the eyes; the antennal flagellum is not much more than two-thirds the length of the body with the rostrum.

The external maxillipeds are very hairy, and the merus has a strong spine on the inner edge near the proximal end.

The chelipeds (in the female) are one-half longer than the body with the rostrum, are slender and cylindrical, and are remarkable for the great length of the carpus, which is equal in length to the palm of the propodite or more than two-thirds the length of the meropodite; all the joints are sharply squamous, the scales on the meropodite, and to a less extent on the carpus (except on the under surface of these joints), forming spines; the fingers are rather more than two-thirds the length of the palm, the opposed edges are finely and closely serrated, the fixed finger having also a second series of distant large teeth and ending in a pair of claws between which the tip of the dactylus closes.

The second, third and fourth legs have the merus and carpus strongly spinate along both edges, the propodite finely serrate on the posterior edge, and the dactylus crenate on the front edge.

In the male there are no appendages on the first abdominal somite.

In an egg-laden female the total length of the body is 35 millim., that of the chelipeds being 53 millim.

Andaman Sea, 112 fathoms: Arabian Sea, off the N. Maldivé Atoll, 210 fathoms.

Regd. Nos.  $\frac{155}{7}$  (Type of the species):  $\frac{1363-1370}{10}$ .

### MUNIDOPSIS, Whiteaves, Faxon.

*Munidopsis*, Whiteaves, Amer. Journ. Sci. (3) VII. 1874, p. 212; Faxon, Mem. Mus. Comp. Zool. XVIII. 1895, p. 81.

*Galathodes*, *Orophorhynchus*, *Elasmonotus*, A. Milne Edwards, Bull. Mus. Comp. Zool. VIII. 1880, pp. 53, 58, 60.

*Anoplnotus*, S. I. Smith, Proc. U. S. Nat. Mus. VI. 1883, p. 50.

*Munidopsis*, *Galathodes*, *Elasmonotus*, *Orophorhynchus*, A. Milne Edwards and Bouvier, Ann. Sci. Nat., Zool. (7) XVI. 1894, pp. 271, 276, 279, 283, and Mem. Mus. Comp. Zool., XIX. No. 2, 1897, pp. 63, 94, 98, 110.

*Galathopsis*, Henderson, Ann. Mag. Nat. Hist. (5) XVI. 1885, p. 417.

*Munidopsis* and *Elasmonotus*, Henderson, Challenger, Anomura, pp. 148, 158.

*Bathyankyristes*, Alcock and Anderson, Journ. As. Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 173 (subgenus).

The integument is very strongly calcified.

Carapace longer than broad, occasionally smooth, usually rugulose, sometimes spinulose; the antero-lateral borders are usually spinose, or dentate, but are occasionally entire and suberistiform; the gastric and cardiac regions are usually well defined. Thoracic sternum broad.

Rostrum well developed: there is sometimes a small supra-antennal tooth or spine on either side of it but never a long supra-orbital spine.

Abdomen simply flexed: some of the anterior terga are, generally, transversely grooved: the pleura behind the 1st are well developed. Tail-fan large and symmetrical, the telson being broad and even more plainly than in *Munida* revealing its component parts (7th abdominal tergum and a pair of appendages incompletely fused together).

Eyes present, but not faceted and not pigmented. Antennular peduncles weak and flexed: the flagella short, especially the lower one.

Antennal peduncle 4-jointed.

The mouth-parts only differ from those of *Munida* in the fact that the exopodites of the 1st maxillipeds have no flagellum.

Epipodites are always present on the 1st and 3rd (external) maxillipeds and are sometimes present on the chelipeds and occasionally on the next 3 pairs of legs also.

The chelipeds are usually more massive than the next 3 pairs of legs: the last pair of legs are weak and are folded.

In the male, paired appendages are present on the first 5 abdominal somites, the first 2 pairs being modified for copulation, and the next 3 pairs being weak and often rudimentary. In the female, paired appendages are present on the 2nd-5th somites.

The branchiæ are 14 on either side arranged as in *Munida*.

The eggs are large and not numerous.

I quite agree with Faxon that the attempt to separate *Blasmonotus*, *Galathodes* and *Orophorhynchus* as well defined genera distinct from each other and from *Munidopsis* is a mistake, since they all grade into one another. In this memoir, one genus, *Munidopsis*, is recognized, but the species are arranged in five groups which may be regarded as subgenera, or not.

Group I. MUNIDOPSIS proper, with the antero-lateral angles of the carapace spiniform, even if the lateral borders are not anteriorly spinose or dentate; with the rostrum styliform or acutely triangular, without any lateral spines; with the chelipeds decidedly longer than the legs and usually, in the male, as long as, or longer than, the fully extended body; and with the eyes terminal on the eye-stalks, which are almost always freely movable.



Group II. Corresponding in the main with Milne Edward's GALATHODES. Antero-lateral angles of the carapace spiniform, even if the lateral borders are not anteriorly spinose: the distal moiety of the rostrum is acute and styliform, and the proximal moiety is broadened, often carinated, and ends anteriorly in a pair of spines one on each side of the base of the styliform portion, so that the rostrum as a whole is more or less distinctly trifid: chelipeds much longer than the legs and, in the male, as long as or longer than the fully extended body: eyes terminal on movable eyestalks.

Group III. The extreme forms of which are included in Milne Edward's genus OROPHORHYNCHUS. The chelipeds are hardly longer, or are even shorter than the ambulatory legs, and in neither sex are as much as three-fourths the length of the fully extended body. The eyestalks are fixed or hardly movable and are always prolonged beyond the eye as a spine or tooth.

Group IV. Corresponding in part with Milne Edward's genus ELASMONOTUS. The lateral borders of the carapace are entire and *subcristiform*, and the antero-lateral angles are not spiniform or dentiform: the rostrum is triangular and simple: the chelipeds are much longer than the legs and longer than the fully extended body: the eyes are terminal on movable eyestalks.

Group V. BATHYANKYRISTES. As Group I., but the propodites of the 2nd, 3rd, and 4th pairs of legs are broadened and are armed at or near their distal end with a clump of spines against which the dactylus can be flexed after the fashion of subchelæ.

*Key to the species included in Group I (Munidopsis).*

- I. Epipodites are present on the chelipeds and next 3 pairs of legs ... *M. hemingi.*
- II. Epipodites are present on the chelipeds only ... .. *M. dasyppus.*
- III. No epipodites on chelipeds or legs: the chelipeds very decidedly longer than the legs:—
  - 1. Dactyli of the 2nd–4th thoracic legs slender and acutely falcate, at least two-thirds the length of the propodites, and with the posterior edge sharp and entire ... .. *M. unguifera.*
  - 2. Dactyli of the 2nd–4th thoracic legs stout, less than two-thirds the length of the propodites, of which the posterior border is almost always serrated:—
    - i. Posterior border of carapace spinose:—
      - a. Rostrum slender, styliform: eyes freely movable ... .. *M. scobina.*
      - b. Rostrum triangular: eyes slightly movable, embedded in a distinct orbital notch ... *M. iridis.*

- ii. Posterior border of carapace smooth :—
- a. Eyes movable: frontal border of carapace smooth :—
- a. Chelipeds of male about as long as the body: transverse carinae of 2nd-4th abdominal terga smooth ... *M. stylirostris*.
- β. Chelipeds of male much longer than the body: transverse carinae of 2nd and 3rd abdominal terga spinose near the middle line ... *M. wardeni*.
- b. Eyes immovable: frontal border of carapace with a large spine on either side behind the base of the antenna ... *M. goodridgii*.
- IV. No epipodites on chelipeds or legs: the chelipeds very little longer than the legs and much shorter than the body ... *M. moresbyi*.

*Key to the species included in Group II (Galathodes).*

- I. Epipodites are present on the chelipeds: anterior border of 2nd-4th abdominal terga spiniferous :—
1. Posterior border of carapace spiniferous ... *M. regia*.
2. Posterior border of carapace smooth ... *M. triæna*.
- II. No epipodites on chelipeds or legs :—
1. Anterior border of 2nd and 3rd abdominal terga and posterior border of carapace spiniferous ... *M. posidonia*.
2. Abdominal terga without spines :—
- i. Posterior border of carapace sharply serrulate ... *M. trachypus*.
- ii. Posterior border of carapace smooth :—
- a. A pair of large spines on the gastric region ... *M. trifida*.
- b. No spines on dorsum of carapace ... *M. tridentata*.

*Key to the species included in Group III (Orophorhynchus).*

- I. The lateral borders of the carapace are non-spinose: the eyestalks are broadened and vertically compressed so that the eyes are distinctly lateral :—
1. Epipodites are present on the chelipeds: integument tomentose: abdominal terga unarmed ... *M. edwardsi*.
2. No epipodites on chelipeds or legs: integument coarsely granular: 2nd-4th abdominal terga with a coarse median spine ... *M. granosa*.
- II. The lateral borders of the carapace are spinose: the eyestalks are not sublaminar :—
1. Epipodites are present on the chelipeds :—
- i. Both the inner and the outer borders of the eyestalk are prolonged beyond the eye as spines ... *M. ciliata*.
- ii. Only the inner border of the eyestalk is prolonged beyond the eye as a spine ... *M. subsquamosa*.

2. No epipodites on chelipeds or legs :—
- i. Posterior border of carapace spiniferous rostrum styli-  
form, with lateral spines ... .. *M. arietina*.
  - ii. Posterior border of carapace smooth: rostrum short,  
simple :—
    - a. No spines on the gastric region ... .. *M. ceratophthal-*  
*mus*.
    - b. Two transverse rows of spines on gastric region *M. centrina*.

Group IV. (Elasmonotus) contains a single species.

*Key to the species included in Group V (Bathyankyristes).*

- I. Rostrum more than half the length of the carapace: much of the eyestalks  
is visible in an ordinary dorsal view ... .. *M. tenax*.
- II. Rostrum half the length of the carapace: only the eyes are visible in a  
dorsal view, not the eyestalks ... .. *M. levis*.

20. *Munidopsis Hemingi*, Alcock & Anderson.

*Munidopsis hemingi*, Alcock and Anderson, Ann. Mag. Nat. Hist. Jan. 1899, p. 19.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE LV. FIG. 4.

Near *M. ornata*, Faxon.

Carapace convex, broader behind than in front, covered with squamiform tubercles in no very conspicuous transverse arrangement, the regions well defined; a pair of tubercles on the anterior part of the gastric region are acute.

Rostrum short, simple, triangular, carinate; anterior border of carapace with a blunt tooth, antero-lateral border cut into three teeth, posterior border unarmed.

Abdomen unarmed, smooth, the second and third terga transversely bicarinate.

Eyes slightly movable, a tiny papilliform spinule at their inner angle.

Inner border of merus of external maxillipeds armed with two large spines.

Chelipeds in the female (male unknown) equal, as long as the extended body without the telson and longer than the legs by their finger-length; their dorsal surfaces are covered with squamiform markings, the only spine is a small one near the distal end of the inner border of the wrist; the fingers are as long as the palm.

The first three pairs of legs have the dorsal surfaces of the meropodites and next two joints covered with squamiform markings; the dactyli are about half the length of their propodites.

Epipodites are present on the chelipeds and three next pairs of legs.

Two specimens—the largest a female 25 millim. long—from off the Travancore coast, 430 fathoms.

The eggs are of enormous size, being nearly 2 millim. in major diameter after contraction in spirit.

The difference between *Munidopsis Hemingi* and *M. ornata*, Faxon, is very slight; in the latter species the edges of the rostrum are serrate and the chelipeds and legs are armed with some spines.

Regd. Nos.  $\frac{2353}{10}$  :  $\frac{2355}{10}$  (Types of the species).

### 21. *Munidopsis dasypus*, Alcock.

*Munidopsis dasypus*, Alcock, Ann. Mag. Nat. Hist., April 1894, p. 329.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XIII. FIG. 9.

Body pubescent; thoracic legs densely covered with long hairs. Epipodites as large as those of the external maxillipeds are present on the chelipeds.

The greatest breadth of the carapace is about three-fourths the greatest length. The rostrum, which is styliform, gently ascendant, and slightly curved at tip, is a little more than half the length of the carapace; the front margin of the carapace is markedly oblique and is unarmed, except for a small antero-lateral spine; the lateral margins are parallel, with a slight convergence in the anterior third, where there are two spinelets behind the antero-lateral spine; the posterior margin is raised and bears four strong spines in its middle third; the general surface of the carapace is smooth and polished anteriorly, and is marked posteriorly by slight transverse ripples.

The anterior abdominal terga have a faint naked transverse groove, the edges of which are quite smooth.

The eyestalks, which are slender and comparatively long, are not prolonged beyond the globular eyes, are not united, and are freely movable.

The inflated basal joint of the antennular peduncle has only one of its spines, namely, that at the antero-external angle, long.

The antennal flagellum is not much longer than the chelipeds (in the female).

The ischiopodite of the external maxillipeds has the inner edge evenly toothed and the lower edge prolonged distally into a huge spine, while the meropodite has two strong spines on the lower edge in the proximal half.

The thoracic legs, except the fifth pair, are thickly covered with long hairs. The chelipeds are long, slender, and slightly asymmetrical, the longer one exceeding the length of the fully extended body (with the rostrum) by the extent of the dactylopodite; their ischiopodite has two strong distal spines, one above, the other below, their meropodite two rows of spines along the upper



and inner surface and a terminal ring of four spines, and the carpopodite has a terminal ring of three spines; the slender fingers, which are finely and evenly toothed to the very tip, slightly exceed the elongate palm in length.

The second, third, and fourth thoracic legs are relatively short, the second pair barely, and the others less than, half the length of the chelipeds; in all the meropodite and carpopodite have the anterior edge spinate, and the dactylopodite has the terminal claw but slightly curved and very much longer than the spines along the posterior edge.

The largest specimen, an egg-laden female, is 48 millim. in extreme length, its chelipeds being 59 millim. long.

Bay of Bengal, off the Andamans, 480 and 561 fathoms; Andaman Sea 498 fathoms; Arabian Sea, 636 fathoms.

Regd. Nos.  $\frac{6901}{9}$  (Types of the species):  $\frac{9322}{9}$  :  $\frac{9330}{9}$  :  $\frac{134-137}{10}$  :  $\frac{2352}{10}$ .

## 22. *Munidopsis unguifera*, Alcock & Anderson.

*Munidopsis unguifera*, Alcock and Anderson, Journ. Asiatic Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 172.  
ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XI. FIG. 4.

Distinguished from all its Indian congeners by the form of the dactyli of the 2nd-4th legs, which are long and talon-like, having the posterior edge sharp and entire.

There are no epipodites on any of the thoracic legs.

The carapace is quadrangular, its surface is coarsely granular, and it is traversed fore and aft by a broken median carina which is surmounted by a few coarse spines: the frontal margin is hardly convex and is quite unarmed, although below it, and between the eye and the antenna, is a spine: the parallel lateral margins are acutely bilobed in front of the cervical groove, while behind it they are denticulated: the posterior margin is multi-spinate: there is a pair of coarse spines on the gastric region.

The rostrum, which is about one-third the length of the carapace proper, is depressed, acute, carinated, and simple.

The abdominal terga are unarmed.

The eyestalks are movable: the inner margin forms a small papilla upon the summit of the cornea. The meropodite of the external maxillipeds has three small teeth on its inner edge. The chelipeds in both sexes are equal to the fully extended body, and are longer and stouter than the other legs: they are unarmed, except for a pair of small spines at the distal end of the meropodite: the fingers are not much shorter than the palm, and have the cutting edges dentate only near the distal end. The 2nd-4th legs have the posterior border of the meropodite serrated: in all the dactyli are remarkable for their great length

—two-thirds that of the propodites, or more—for their long acute points, and for the trenchant posterior edges.

This is a small species, egg-laden females measuring not more than 25 millim.

Colours, salmon-red to chestnut-brown.

Bay of Bengal, 145–250 and 193 fathoms : Andaman Sea, 490 fathoms.

Regd. Nos.  $\frac{4226-4231}{7}$  (Types of the species) :  $\frac{50}{7}$  :  $\frac{6256-6258}{7}$ .

### 23. *Munidopsis scobina*, Alcock.

*Munidopsis scobina*, Alcock, Ann. Mag. Nat. Hist., April 1894, p. 330.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XIII. FIG. 1.

Body and appendages almost devoid of hairs, but with the spinature sharp and distinct. No epipodites are present on any of the appendages behind the external maxillipeds.

The greatest breadth of the carapace is about six-sevenths of its length. The rostrum, which is styliform and slightly recurved at tip, is not quite half the length of the carapace; the frontal border is very slightly oblique and, except for one or two small spinelets above the base of the antennæ, is smooth; the lateral borders, which are convergent anteriorly, are from six- to ten-spined; the posterior border is raised and is surmounted by a series of about ten spines; the gastric region bears a pair of spines at the base of the rostrum and a row of spines along the middle line, and this row is continued along the cardiac region, some of the spines there being bifid or trifid; on the branchial regions are numerous sharp tubercles and spines.

The abdominal terga and pleura are glabrous; the second, third, and fourth terga are deeply channelled transversely, the edges of the channel forming sharp and very evenly spinate crests.

The eyestalks are very short, free and freely movable, and not prolonged beyond the ovoid eyes.

The basal joint of the antennular peduncles has three large terminal spikes of nearly equal length, the innermost of which may be bifid or trifid.

The spines on the joints of the antennal peduncles are remarkably distinct and the flagellum is about twice as long as the body.

The ischiopodite of the external maxillipeds is evenly toothed along the inner edge and has a terminal spine on the lower edge, and the meropodite has two spines near the proximal end on the lower edge.

The thoracic legs are granular, or squamous, or spinate. The chelipeds are somewhat longer, but hardly stouter, than the second, third, and fourth legs, and in the male they are somewhat longer and in the female somewhat shorter than

the fully extended body (with the rostrum); all their joints except the first and last are more or less thorny; the fingers are long, slender, and finely toothed, being in the male a little longer than, and in the female about the same length as, the palm.

The second, third, and fourth legs have the anterior edge of the ischiopodite and carpus thorny and the teeth on the posterior edge of the dactylopodite small.

The abdominal legs of all but the first two pairs are rudimentary in the male; those of the first pair are absent in the female.

Colours in life dirty white, or reddish, with orange red markings.

The extreme length of the largest male is 51 millim.; its chelipeds are also 51 millim.

Northern end of Bay of Bengal, 193, 240, 272, 405-285 and 409 fathoms.

Regd. Nos.  $\frac{6902-6903}{9}$  (Types of the species):  $\frac{474-482}{7}$ :  $\frac{484-488}{7}$ :  $\frac{491-501}{7}$ :  $\frac{4232}{7}$ :  $\frac{6259}{9}$ .

#### 24. *Munidopsis iridis*, Alcock & Anderson.

*Munidopsis iridis*, Alcock and Anderson, Ann. Mag. Nat. Hist., Jan. 1899, p. 20.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLIV. FIG. 1.

Extremely closely related to *M. margarita*, Faxon.

There are no epipodites on any of the thoracic legs.

Carapace subquadrilateral, convex, its regions well delimited and tumid, its surface armed with numerous acute subsquamiform tubercles and symmetrically disposed spines, of which a pair on the anterior part of the gastric region and one in the middle of the cardiac region are slightly enlarged.

Rostrum short, simple, triangular, carinate, its edges indistinctly serrulate in their distal half; anterior border of carapace armed with an acute spine at the outer angle of the orbital notch; lateral borders armed with four acute spines, posterior border with several spines; a row of spinules above the postero-lateral border.

Second, third, and fourth abdominal terga transversely bicarinate, the first three or five carinæ bearing symmetrically disposed spines; the corresponding pleura are unicarinate, the anterior of them (second) having a single upstanding spine.

Eyes almost immovable; an inconspicuous spinule at their inner angle.

Three spines, two of which are large, on the inner border of the merus of the external maxillipeds.

Chelipeds markedly unequal in the male, very rarely slightly unequal in the female; in both sexes the dorsal surfaces of the arm and wrist are spiny, a

few of the spines along the inner edge being enlarged, and the inner edge of the palm is spinulose.

In the adult male both chelipeds are vastly stouter than the legs: the larger is about half as long again as the fully extended body and from a dactylus to half a dactylus longer than its fellow, and has the hand enlarged and the immovable finger so arched that the fingers meet only at tip; the smaller cheliped is very variable, sometimes it is hardly different from its fellow, but usually it is more slender, especially in respect of the hand, and usually the fingers meet throughout the greater part of their extent.

In the female the chelipeds are stouter, but not vastly stouter, than the legs, and are about as long as the fully extended body, and the fingers are nearly straight.

The legs are about as long as the body in its natural pose (with the abdomen bent) and are scabrous; the anterior border of the merus and carpus is spiny, the dactylus is nearly half the length of its propodite and has its posterior border almost imperceptibly serrulate.

The sternum and neighbouring joints of the legs are beautifully iridescent, as also sometimes is the dorsal surface of the bent-up portion of the abdomen.

Fifty-two specimens from off the Travancore coast, 430 fathoms.

An adult male has the body 26.5 millim. in extreme length and the larger cheliped 38 millim. long. An egg-laden female is 21 millim. long and its chelipeds measure the same.

Regd. Nos.  $\frac{1926-1928}{10}$  :  $\frac{1940}{10}$  :  $\frac{2177-2181}{10}$  :  $\frac{2183-2201}{10}$  (Types of the species).

## 25. *Munidopsis stylirostris*, Wood-Mason.

*Munidopsis stylirostris*, Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 201; Alcock, Ann. Mag. Nat. Hist., April 1894, p. 328.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XIII. FIG. 6.

The general surface of the body is finely pubescent dorsally. There are no epipodites on any of the thoracic legs.

The greatest breadth of the carapace is about three-fourths of the greatest length (without the rostrum). The rostrum, which is styliform and strongly upcurved, is nearly two-thirds of the carapace in length; the front margin of the carapace is slightly oblique, and is unarmed except for a strong oblique spine at the antero-lateral angle, and the lateral margins, which are parallel throughout or even a little divergent anteriorly, are, except for the antero-lateral spine, either unarmed or only slightly rugose anteriorly; the posterior margin is raised, but is quite smooth; the tumid gastric region is marked by the presence of rugosities which anteriorly culminate in a pair of coarse spinelets or tubercles, one on each side of the middle line.



The abdominal terga from the second to the fourth inclusive are transversely channelled, both margins of the channel being raised into microscopically ctenate crests.

The eyestalks, which are very stout and very short, are not united, are freely movable, and are not prolonged beyond the globular eyes.

The greatly inflated basal joint of the antennular peduncles has the two external terminal spines very strong and long, projecting far beyond the eyes.

The antennal flagellum is not much longer than the chelipeds.

The external maxillipeds have the inner edge of the ischiopodite evenly toothed throughout and the lower edge of the meropodite furnished with two large unciform spines near the proximal end.

The thoracic legs, except the ischiopodite of the first pair, are almost devoid of hairs.

The chelipeds are robust and are not quite symmetrical on both sides, the longer one being about an eye-length shorter than the fully extended body (measured with the rostrum); their meropodite and carpopodite have each a terminal ring of four spines, the meropodite also having a series of distant spinelets along the upper margin in continuity with a terminal spine on the upper edge of the ischiopodite, and the last-named joint having also a terminal spine below; their fingers, which are barely equal in length to the inflated palm, are finely and evenly toothed up to the very tip, are capable of very complete apposition, and when shut form a pronounced spoon.

The second, third, and fourth thoracic legs are at least two-thirds the length of the chelipeds, and have the meropodite and carpopodite granular (the former joint with a pair of terminal spines above, the latter with a single one), and the curved dactylopodite furnished on its posterior margin with a row of spines hardly smaller than the terminal claw.

The abdominal legs of the male, excepting the first and second pairs, are quite rudimentary.

The length of the largest male from the tip of the rostrum to the end of the telson is 44 millim., and of the chelipeds 44 millim.

Colours in life milky orange, fading to milk-white on the carapace and sternum; eyes milky yellow.

Arabian Sea, 738, 824, 836 and 947 fathoms.

Regd. Nos.  $\frac{543}{7}$  (Type of the species):  $\frac{537}{7}$ :  $\frac{9323}{9}$ :  $\frac{110-112}{10}$ :  $\frac{2351}{10}$ :  $\frac{2361-2362}{10}$ .

## 26. *Munidopsis Wardeni*, Anderson.

*Munidopsis Wardeni*, Anderson, Journ. Asiatic Soc. Bengal, Vol. LXV. pt. 2, 1896, p. 99.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE LV. FIG. 1.

This species is very closely related to *M. stylirostris*, W. M., but differs in

the following particulars. 1. The chelipeds are much longer. 2. The carapace is hairier, flatter and broader. 3. The rostrum is relatively shorter and slopes gently downwards, its curve being nearly continuous with that of the anterior part of the carapace; its extreme tip is upturned. 4. The eyes are cylindrical and slightly curved. 5. The spine at the antero-lateral angle of the carapace is much smaller and directed forwards and not obliquely outwards at an angle of about 45°. 6. The cervical groove is bounded posteriorly on the lateral margin, by a small spine; in *M. stylirostris* both groove and spine are very inconspicuous. 7. The merus of the cheliped has two rows of spines on its upper surface, one on the inner the other near the outer margin. 8. All the joints of the 2nd, 3rd and 4th thoracic legs are hairy. 9. The ridge bounding the transverse furrow of the 2nd and 3rd abdominal terga is spinulose in the middle line, as is also sometimes that of the 4th.

Colours in life were the same as those of *M. stylirostris*; milky orange dorsally, white ventrally, eyes yellow.

As in *M. stylirostris*, there are no epipodites on any of the appendages behind the external maxillipeds.

The length of the largest male, from tip of rostrum to end of telson is 54 millim., its chelipeds being 92 millim.

Arabian Sea, 406, 457-589, 459 and 531 fathoms: Bay of Bengal, 480 and 594-225 fathoms.

There are in the collection two small specimens, of this species, dredged off the Andamans in 500 fathoms, in which the abdominal terga have no spines.

Regd. Nos.  $\frac{116-117}{10}$  (Types of the species):  $\frac{139}{7}$ :  $\frac{782}{10}$ :  $\frac{1353-1355}{10}$ :  $\frac{1389}{10}$ :  $\frac{3417}{10}$ :  $\frac{3754}{10}$ :  $\frac{3755-3757}{10}$ .

## 27. *Munidopsis Goodridgii*, Alcock & Anderson.

*Munidopsis goodridgii*, Alcock and Anderson, Ann. Mag. Nat. Hist., Jan. 1899, p. 21.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLIV. FIG. 2.

Differs from all known Indian species in having the eyes absolutely immovable, yet furnished with neither spine nor spinule. Its nearest relative is, perhaps, the Philippine species *M. Milleri*, Henderson.

Carapace subquadrangular, convex, slightly broader behind than in front, its regions well delimited, its posterior half deeply sculptured transversely.

Gastric region with some not very conspicuous squamiform sculpture and with a pair of large spines situated anteriorly; a spine on either side of, and a pair of spinules in the middle of, the anterior cardiac region.

Rostrum short, simple, rather slender, smooth. A large acute spine on the anterior margin of the carapace; lateral borders with two large spines and a spinule, posterior border smooth.

Abdomen smooth, the second tergum transversely bicarinate, the third transversely grooved.

Eyes quite immovable, without spine or spinule. Two large spines on the inner edge of the merus of the external maxillipeds.

Chelipeds in the female (male unknown) slender, unequal, the larger one slightly longer, the smaller one very slightly shorter, than the fully extended body; two rows of spines on the arm, both series continued, but much less conspicuously, along the wrist, but not along the hand; the fingers meet throughout their length. No epipodite on any of the thoracic legs.

Legs long, the first three pairs being scarcely shorter than the fully extended body: their merus has a few spinules at the proximal end of its anterior border, and both its borders terminate acutely; their carpus is carinate and ends in a spine; their dactylus is more than half the length of the propodite and has its posterior border spinulate.

A single female from off the Travancore coast, 430 fathoms.

The length of the carapace is 21.5 millim., of the larger cheliped 24 millim., of the smaller cheliped 21 millim.

Regd. No.  $\frac{2354}{10}$  (Type of the species).

## 28. *Munidopsis Moresbyi*, Alcock & Anderson.

*Munidopsis moresbyi*, Alcock and Anderson, Ann. Mag. Nat. Hist., Jan. 1899, p. 22.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XL. FIG. 3.

Carapace convex, broader behind than in front, covered as far as the tip of the rostrum with transverse, squamiform, ciliated sculpture, spineless, the regions inconspicuous.

Rostrum of moderate length, simple, broadly and acutely triangular, dorsally carinate. A blunt tooth on the anterior border of the carapace; lateral borders cut into two blunt lobes exclusive of the subacute antero-lateral angle, but these lobes may be almost indistinguishable; posterior border smooth.

Abdomen unarmed, the second to the fifth terga transversely grooved; the fifth and sixth terga, the telson and the outer half of the blades of the swimmeret, and the margins of the pleura with a fine, rather irregular, squamiform sculpturing.

Eyes freely movable, spineless, more or less retractile beneath the rostrum.

Two very inconspicuous teeth on the inner edge of the merus of the external maxillipeds.

Chelipeds and legs covered with ciliated squamiform sculpturing, unarmed.

Chelipeds moderately stout, equal in both sexes, much shorter than the fully extended body, not half a dactylus longer than the legs; palm and fingers



as long as the three preceding joints combined, the fingers slightly longer than the palm.

The dactyli of the legs are about half the length of the propodites and have the posterior border serrated.

There are no epipodites on any of the thoracic legs.

Colour in life pink.

In the male the length of the fully extended body is 38 millim., and that of the chelipeds 27 millim.

Arabian Sea, off the Travancore coast, 430 fathoms.

Regd. Nos.  $\frac{2346-2347}{10}$  (Types of the species).

## 29. *Munidopsis (Galathodes) trifida*, Henderson.

*Munidopsis trifida*, Henderson, Ann. Mag. Nat. Hist. (5) XVI. 1885, p. 415, and Challenger Anomura, p. 156, pl. xvi. fig. 2; Alcock and Anderson, J.A.S.B. Vol. LXIII. pt. 2, 1894, p. 168.

*Galathodes trifidus*, Milne Edwards and Bouvier, Ann. Sci. Nat. Zool. (7) XVI. 1894, p. 279.

No epipodites on any of the thoracic legs.

Body and appendages tomentose. Carapace when denuded transversely rugose, especially postero-laterally.

Rostrum about half the length of the carapace proper: its distal half is acutely styliform, but its basal half is broad and vertically compressed and ends in a pair of spines, one on each side of the styliform ending.

The very oblique frontal border of the carapace is armed with a spinule, post-antennal in position, and there is a large spine below the frontal margin, between the eye and the antenna. The lateral margins are armed with 4 large procurved spines. The posterior border is smooth. The only spines on the dorsum of the carapace are a large pair on the anterior portion of the gastric region. There are no spines on the abdomen.

The eyes are movable and are terminal on the eyestalks.

The chelipeds in both sexes are longer than the body, and in the male have massive hands: the ischium has three longitudinal rows of large spines and 4 large terminal spines: the carpus has two rows of spines and 3 terminal spines: both edges of the outer surface of the palm are spinose: the fingers are as long as the palm, and in the male the cutting edge of the fixed finger is excavated at its proximal end to give room to a large molariform tooth on the opposed edge of the dactylus: in the female the fingers are straight.

The next three pairs of legs are much shorter than the chelipeds: their merus and carpus are spinose along the anterior margin, and their dactylus, which is about half the length of the propodite, has the posterior margin serrated.



In the external maxillipeds the dorsal and ventral borders of the ischium end each in a spine, and there are two very strong spines on the ventral border of the merus, while the dorsal border of the same joint ends in a small spine.

Length of fully extended body of male 44 millim., of egg-laden female 43 millim.; of chelipeds of male 53 millim., of female 48 millim.

Arabian Sea, north of the Laccadives, 636 fathoms; Bay of Bengal, off the Andamans, 480 fathoms; Andaman Sea, 498 fathoms.

Regd. Nos.  $\frac{141}{7}$  :  $\frac{9324}{9}$  :  $\frac{2330-2331}{10}$ .

### 30. *Munidopsis (Galathodes) triena*, Alcock & Anderson.

*Munidopsis triena*, Alcock and Anderson, Journal Asiatic Soc. Bengal, LXIII, pt. 2, 1894, p. 168.  
ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XI. FIG. 5.

Differs from *M. trifida* only in the following particulars:—

The appendages are much less pilose and the body is almost devoid of tomentum: the rostrum is a good deal more than half the length of the carapace: there is a large spine on the cardiac region: the front edges of the second to fourth abdominal terga are armed in the middle line, the second with a large hook-shaped spine; the third and fourth with a pair of spines: the chelipeds are much less spiny, the hand being quite smooth, and the carpus having only a pair of distal spines: the carpopodites of the second to fourth legs have only a single spine, terminal in position, on the front border.

There is an epipodite on the chelipeds as large as that of the external maxillipeds.

Length of fully extended body of female 23 millim.; of chelipeds 19.5 millim.

Bay of Bengal, off the Andaman coast, 240–290 and 375 fathoms.

Regd. Nos.  $\frac{6261-6263}{9}$  (Types of the species) :  $\frac{3221}{9}$ .

### 31. *Munidopsis (Galathodes) regia*, Alcock & Anderson.

*Munidopsis regia*, Alcock and Anderson, Journ. Asiatic Soc. Bengal, Vol. LXIII, pt. 2, 1894, p. 168.  
ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XI. FIG. 1.

The entire dorsal surface both of body and of appendages is covered with a remarkably thick velvety down. Epipodites, which are as large as those of the external maxillipeds, are present on the chelipeds.

The rostrum, which is half the length of the carapace proper, is moderately broad, convex, carinated, and armed in its anterior half with a single pair of strong divergent spines.

The carapace is semi-elliptical, and strongly convex, and is traversed fore and aft in the middle line by a raised row of coarse granules or spinules, of which

one in the postcardium is constant,—in addition to a pair of large spines, disposed transversely, in the front part of the gastric region: the frontal margin is convex, and is armed with two spines, one above the antenna on each side, while below the frontal margin a large spine is interposed between the eye and the antenna: the lateral margins are deeply trilobed in front of the cervical groove, each lobe culminating in a spine, while behind the cervical groove is a row of three smaller and successively decreasing spines: the posterior border is broadly raised and armed with some spines.

Of the abdominal terga the second has, in the middle line, on the front edge, one strong tooth, while the third and fourth have in the same situation a pair.

The eyestalks are freely movable, and are not prolonged beyond their cornea. The thoracic appendages have many long setæ in addition to the general investment of down. The external maxillipeds have the meropodite armed, on the inner border, near the proximal end, with two very large unciform spines, and, on the outer border, distally, with a strong spine. The chelipeds are considerably longer than the fully-extended body, but are stout: the ischiopodite has two distal spines, one above, the other below: the meropodite has three series of strong spines along its inner and upper surface: the carpopodite has a distal ring of teeth, and a few sharp tubercles on its upper and outer surface: the hand is unarmed, the fingers being about two-thirds the length of the palm. The second to fourth thoracic legs have the meropodite and carpopodite spiny: in all the dactylus is remarkably long (about two-thirds the length of the propodite) and remarkably hairy on both edges, the posterior edge also being multi-spinate. The telson, which, as is usual in this genus, appears quite plainly to consist of a somite and incompletely fused appendages, has its postero-lateral angles remarkably thickened and recurved, and its lateral borders thickly clothed with setæ of a peculiarly firm consistence and of a dark colour.

Colour in life, chalky pink.

In the largest specimen the length of the fully extended body is 111 millim., and that of the chelipeds 205 millim.

Arabian Sea, off Colombo, 142–400 fathoms: Andaman Sea, 405 fathoms.

In one specimen there are two spines on one side of the rostrum.

Regd. Nos.  $\frac{8815}{9}$  (Type of the species):  $\frac{1351-1352}{10}$

### 32. *Munidopsis (Galathodes) trachypus*, Alcock & Anderson.

*Munidopsis trachypus*, Alcock and Anderson, Journ. Asiatic Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 169.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XI. FIG. 2.

Carapace and appendages everywhere closely, sharply, and evenly spinate. No epipodites are present on any of the thoracic legs.

The rostrum, which is about one-third the length of the carapace, is broadly lamellar and trifold, is finely serrated at the sides, and is traversed by a finely serrated carina that extends uninterruptedly to the cervical groove.

The carapace is markedly convex and semi-elliptical: the frontal margin is strongly convex and is armed with two spines, one above the base of the antenna on each side: the lateral margins are multiserrate: the posterior margin is raised, and like the rest of the carapace, is sharply and evenly granular: all the regions of the carapace are well delimited.

The abdominal terga are smooth, the telson alone, like the outer halves of the caudal swimmerets, being finely granular.

The eyes are movable, and the eyestalks are not prolonged beyond their cornea: there is a considerable interval between them and the antenna, but no spine.

The antennal peduncles are remarkably slender, and are not longer than the eyes (which are not half the length of the rostrum): the flagella appear to have been not longer than the carapace. The external maxillipeds are small and slender: the meropodite has two large unciform spines (the proximal one slightly bicuspid) on the inner edge near the base, and a large terminal spine on the outer edge.

The chelipeds are remarkably long and slender, being, even in the female nearly twice the length of the fully extended body: they are closely thorny, on every surface, up to the base of the fingers: the palm is more than three times the length of the fingers. The longest of the second to fourth thoracic legs is not much more than half the length of the chelipeds: all are densely spiny up to the remarkably short dactyli, which are hardly one-fourth the length of the propodites: a spine at the distal end of the meropodite is pre-eminent in all.

Length of fully extended body 54 millim., of chelipeds 100 millim. Colours in life, pale salmon.

Arabian Sea, north of the Laccadives, 636 fathoms.

Regd. No.  $\frac{9325}{9}$  (Type of the species).

### 33. *Munidopsis (Galathodes) posidonia*, Alcock & Anderson.

*Munidopsis posidonia*, Alcock and Anderson, Journ. Asiatic Soc. Bengal, LXIII, pt. 2, 1894, p. 167.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XII. FIG. 2.

The dorsal integument of body and appendages is finely scabrous beneath the usual pubescence.

The rostrum, which is about one-third the length of the carapace proper, is vertically compressed, carinated, and trifold at tip.



The carapace is elliptical, convex, and traversed fore-and-aft by a median multispinate ridge,—some of the spines being bifid and trifid: the frontal margin is convex and bears two spines, one above the base of either antenna, while just below the frontal margin, between the antenna and the eye, is a spine nearly as long as the eye: the lateral margins in front of the cervical groove are sharply quadridentate—the anterior of the four spines having a second spine to its inner side—while behind the cervical groove they are spinate: the posterior margin, like the front edge of the second and third abdominal terga, is spinate: in addition to the spines already noticed there is a pair of large spines on the gastric region, and there are some small spinules on the after margin of the cervical groove.

The eyestalks are not prolonged beyond the cornea, and are movable. The meropodite of the external maxillipeds has, on its inner edge near the proximal end, two large unciform spines, and, at the distal end of its outer edge, another large spine. The chelipeds slightly exceed the fully extended body in length, and are slender: the ischiopodite has two distal spinelets, one above, the other below: the meropodite has three series of thornlike spines along its upper and inner surface: the carpopodite has a distal ring of spines, and a row of spinules along its inner edge: the hand is smooth, the fingers being about three-fourths the length of the palm. The second to the fourth thoracic legs have the meropodite and carpopodite spiny along the front edge, and the dactyli, which are about half the length of the propodites, of the usual form. There are no epipodites on any of the thoracic legs.

Length of fully extended body 53.5 millim., of chelipeds 58 millim.

Bay of Bengal, off Madras coast, 210 fathoms.

Regd. No.  $\frac{4225}{7}$  (Type of the species).

#### 34. *Munidopsis (Galathodes) ? tridentata*, Esmark.

*Galathea tridentata*, Esmark, Forhdl. Skandin. Naturf. 7 Möde (1856), p. 157.

*Galathodes rosaceus*, A. Milne Edwards, Rec. de Fig. de Crust. pl. xiii. fig. 1. 1883.

*Galathodes tridentata*, A. M. Edw. and Bouvier, Crust. Hirondelle et Princesse Alice, Monaco, 1899, p. 83 (and ref.).

*Munidopsis rosacea*, Alcock and Anderson, Ann. Mag. Nat. Hist., Jan. 1899, p. 19.

No epipodites are present on any of the thoracic legs.

Carapace and legs transversely rugulose. Rostrum hardly half the length of the carapace proper, broad, vertically compressed, carinated, ending in a trifid tip of which the middle spine is the longest.

Frontal border of carapace with an acute tooth post-antennal in position: lateral border with 4 small teeth; posterior border smooth.

No spines on dorsum of carapace or on the abdomen.



Eyes movable, terminal on the eyestalks, almost hidden by the rostrum.

The ventral border of the ischium of the external maxillipeds ends in a spine, and there are two large spines on the same border of the merus.

The chelipeds in both sexes are massive and are longer than the fully extended body, and they vary very greatly in form: on the merus there are generally two longitudinal rows of spines, the inner of which is the most conspicuous and most constant, and there is always a large subterminal spine on the inner border of the carpus: the fingers, which are shorter than the palm, may either be quite straight (as they usually are in the female), or the fixed finger of one or both hands may be arched outwards and excavated along its cutting edge, so as to meet its fellow only at tip (as is usually the case in adult males).

In the next 3 pairs of legs the anterior border of the merus and carpus is coarsely serrated, and the dactylus, which is not much more than half the length of the propodite, is stout and has the posterior border serrated.

In an egg-laden female the length of the fully extended body is 25 millim., and of the chelipeds 27 millim. In males of the same size the chelipeds are 30 millim. long.

237 specimens were taken in the Arabian Sea, off the Travancore coast, in 430 fathoms. Also taken off the N. Maldive Atoll in 210 fathoms, and in the Bay of Bengal off Ceylon in 296-320 fathoms.

Regd. Nos.  $\frac{783}{10} : \frac{1380}{10} : \frac{2215-2314}{10}$ .

35. *Munidopsis (Orophorhynchus) Edwardsii* (Wood-Mason).

Plate III. fig. 4.

*Elasmonotus edwardsii*, Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 201.

*Orophorhynchus edwardsii*, Milne Edwards and Bouvier, Ann. Sci. Nat., Zool., (7) XVI. 1894, p. 287.

Body and appendages covered with a velvety tomentum.

Rostrum broad, acutely triangular, simple, less than half the length of the carapace, dorsally carinated.

Frontal border of carapace oblique, with a sharp supra-antennal tooth: antero-lateral angle of carapace subacute, behind it the lateral margin is bilobed, the anterior lobe, which occupies all the space between the two branches of the cervical groove, having a salient subacute cristiform margin: posterior border of carapace smooth: dorsum of carapace unarmed, as also is the abdomen.

Eyestalks vertically compressed, sublaminar, fused and fixed, produced beyond the small laterally-compressed eye into a coarse spine.

Ventral border of merus of external maxillipeds obscurely serrated.

Chelipeds of the male hardly longer than the combined carapace and rostrum: the ischium has a subterminal spine on the produced ventral border;

the merus has a row of spinules along its dorsal border, and all its borders end in spines; the carpus has some granules and denticles on its upper surface, and a strongish spine on its inner border; the hand is smooth, with the fingers blunt, spooned, and about as long as the palm.

An epipodite is present on the chelipeds.

The next 3 pairs of legs are longer than the chelipeds, the anterior border of their merus and carpus is strongly spinose, and the dactylus is strong, more than half the length of the propodite, and serrated along the posterior margin.

Colour in the fresh state milk-white.

Length of fully extended body of male 43 millim., length of chelipeds 24 millim.

Bay of Bengal, 1300 and 1310 fathoms.

Regd. Nos.  $\frac{6010}{9}$  (Type of the species):  $\frac{7668}{6}$ .

36. *Munidopsis (Orophorhynchus) granosa*, n. sp.

Plate III. fig. 1.

Carapace and abdomen as well as the chelipeds and legs closely covered with small confluent crystalline tubercles, without any setæ.

Rostrum very broad, triangular, acute, simple, not a third the length of the rest of the carapace, dorsally carinated, the carina continued on to the gastric region: its basal angle forms a small supra-antennal tooth.

The antero-lateral angle of the carapace forms a sharp right angle. The lateral borders are inflated and, like the posterior border, share in the general granulation of the carapace.

In addition to the general granulation, the 2nd, 3rd and 4th abdominal terga culminate in the middle line each in a sharp coarse tooth.

Eyestalks vertically compressed, sublaminar, slightly movable, only slightly produced beyond the small laterally-placed eye.

Chelipeds in the male only slightly longer than the carapace and rostrum, closely granular but without any spines, fingers blunt, spooned, about as long as the palm.

The next 3 pairs of legs are slightly longer than the chelipeds, and like them are closely granular but unarmed: the dactyli, which are strong, are nearly as long as the propodites, and are sharply toothed at the distal end of the posterior border.

There are no epipodites on the chelipeds or legs.

Length of fully-extended body of male 41 millim., length of chelipeds 22 millim.

Bay of Bengal 1520 fathoms.

Regd. No.  $\frac{77}{7}$  (Type of the species).

37. *Munidopsis (Orophorhynchus) ciliata*, Wood-Mason.

*Munidopsis ciliata*, Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 200: Faxon, Mem. Mus. Comp. Zool. XVIII. 1895, p. 84.

*Munidopsis brevimana*, Henderson, Ann. Mag. Nat. Hist. (5) XVI. 1885, p. 414, and Challenger Anomura, p. 154, pl. xvii. figs. 1, 2.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XI. FIG. 3.

The specimen in the Indian Museum, which was dredged in the Bay of Bengal, in 1310 fathoms, agrees in every particular with Henderson's description. Faxon has explained the necessity for adopting Wood-Mason's name, and has pointed out the close relation of this species to *M. nitida* A. M. Edw. from the West Indies.

To Henderson's description, which is quoted below, I may add that an epipodite is present on the chelipeds.

In our specimen, which is a male, the length of the fully extended body is 35 millim., and that of the chelipeds 19 millim.

The colour in the fresh state was milk white.

"The carapace is glabrous and covered with short transverse ridge-like elevations, which exist in greatest number on the posterior half; in some specimens also short hairs are sparingly met with. The gastric area is swollen, and armed in front with two prominent spines placed behind the base of the rostrum, while the short transverse ridges are comparatively few in number; the cardiac area is circumscribed, and a deep furrow crosses it transversely near the middle; the ridges are strongly marked, and lengthen out somewhat on the branchial regions. The rostrum is narrow and acute, slightly elevated towards the apex, and carinated superiorly, its length being less than half that of the carapace. The lateral margin of the carapace is armed with five spines, three of which are situated between the two divisions of the cervical groove, and the first of this trio reaches the greatest size; a single spine is placed on the antero-lateral margin behind the antennal peduncle; the posterior margin is prominent, but unarmed.

"The chelipedes are stout and remarkably short, with the joints pubescent, and the merus and carpus somewhat spiny above. The lower surface of the ischium is produced anteriorly, and a spinule is present near the apex of this process; the propodus is almost smooth, and dilated both from side to side and from above downwards; the fingers are short and stout, with their opposed surfaces deeply excavated, and the apical margins finely toothed; numerous short tufted hairs are present towards the apices, and the outer surface of the

immobile finger carries a denticulate carina. The ambulatory limbs are of moderate length, and the posterior surfaces of the meri and carpi are tuberculate, while their anterior margins are strongly spinose; the posterior surface of the propodi is carinated; the dactyli are only curved towards the apex, and their posterior margins are denticulate, the teeth increasing in size towards the terminal claw.

“The eyes still retain a certain amount of mobility, and are separated ventrally by from one to three small calcified pieces; the cornea is rounded, and the peduncle is prolonged into two slender lateral spines, the inner of which is about twice the length of the other. The antennal flagellum is more than twice the length of the body. The merus of the external maxillipeds has its inner margin irregularly dentate.

“The abdominal segments are comparatively smooth, a few granulations being present merely on the posterior ones; the second, third, and fourth each bear a curved transverse sulcus, the convexity of which is directed forwards.”

Regd. No.  $\frac{6011}{9}$ .

38. *Munidopsis (Orophorhynchus) subsquamosa*,  
Hndrsn. var. *pallida*, Alcock.

*Munidopsis subsquamosa* var. *pallida*, Alcock, Ann. Mag. Nat. Hist., April 1894, p. 331.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XIII. FIG. 7.

The carapace to the very tip of the rostrum is covered with hairy squames arranged in transverse series; its greatest breadth is about six-sevenths of its length. The rostrum, the length of which is about two-fifths that of the carapace, is broad, being at its base nearly one-third the breadth of the carapace, triangular, and strongly carinated, and upcurved and serrated at tip; the frontal border is in the same convex curve with the anterior portion of the lateral borders, it bears on each side a strong supra-antennal spine, and there is also a strong antero-lateral spine, behind which, on the lateral border, is a still stronger spine followed by two or three spinules: the posterior border is raised and quite smooth; the gastric and cardiac regions are well defined, the former having a pair of spines on the middle line in front.

The abdominal terga and pleura are squamous and hairy, but are not spinate; the second, third, and fourth terga are grooved transversely.

The eyestalks, which are short and stout, are united with one another at base and are almost immobile, each is prolonged beyond the cornea into a stout spine, which projects obliquely from beneath the base of the rostrum, to which, at first sight, it appears to belong.

The basal joint of the antennular peduncles is stout, but not inflated; of the two external terminal spines only one—the lower—is large and conspicuous.



The antennal flagellum is three times as long as the cheliped.

The external maxillipeds are short and slender, the ischium having the inner border finely ctenate and the meropodite having the lower border irregularly crenulate.

The thoracic legs are granular, or squamous, or spinulate, and moderately hairy.

The chelipeds are shorter and not very much stouter than the second, third, and fourth legs, their length being considerably less than half that of the body (with the rostrum); in the male they are slightly asymmetrical; the meropodite and carpus have each a terminal ring of spinelets, and the fingers, which are longer than the inflated palm, are coarse, and are excavated *en cuillère* at tip, being closely crenulate round both edges of the spoon-shaped tips, but not toothed in the proximal half.

The second, third, and fourth thoracic legs have the joints remarkably prismatic and the carpus and propodite strongly fluted; in all the anterior border of the meropodite and carpopodite is spinate, and the teeth on the posterior border of the dactylopodite are small, the dactylopodites being more than half as long as the propodites.

The chelipeds carry a large epipodite.

Colour in life brilliant white.

In the male the length of the fully extended body is 59 millim., that of the chelipeds is 36 millim.

Bay of Bengal, 1803 fathoms.

This variety appears to differ from the type in having only a pair of gastric spines and in the greater distinctness of the cardiac region.

Regd. No.  $\frac{6907}{9}$ .

### 39. *Munidopsis (Orophorhynchus) arietina*, Alcock.

*Munidopsis arietina*, Alcock and Anderson, Journ. Asiatic Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 171.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XII. FIG. 3.

Belongs to the *Munidopsis abbreviata* and *brevimana* group, but is distinguished from all its congeners by its enormous up-curved spiny *Heterocarpus*-like rostrum.

Carapace semi-elliptical. The rostrum, which is acutely styliiform and strongly up-curved, is equal in length to the carapace, its tip reaching almost to the end of the fully extended chelipeds: its sides are acutely but unsymmetrically spinate.

The convex frontal margin is unarmed, except for the antero-lateral spine: the lateral margins besides this spine are armed with a second spine in the

hepatic region, and a third in the branchial: the posterior margin is strongly spinate: on the gastric region are two pairs of spines—a large pair in front, and a small inconspicuous pair behind: on the cardiac region also is a pair of small spines.

The abdominal terga are unarmed.

The eyestalks, which are slightly mobile, are prolonged internally beyond the cornea to form a spine. The meropodite of the external maxillipeds has its inner edge faintly serrated. The chelipeds are rather shorter than the ambulatory legs, and have short broad hands. The 2nd–4th legs have dactyli of the usual form.

No epipodites are present on any of the thoracic legs.

Length of fully extended body 27·5 millim., of chelipeds 15 millim. Bay of Bengal, 1520 fathoms.

Regd. No.  $\frac{78}{7}$  (Type of the species).

#### 40. *Munidopsis (Orophorhynchus) centrina*,

Alcock & Anderson.

*Munidopsis centrina*, Alcock and Anderson, Journ. Asiatic Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 170.  
ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XI. FIG. 6.

Belongs to the group *Munidopsis abbreviata*, A. M.-E., *M. brevimana*, Hndrsn., *M. ciliata*, W.-M., and *M. vicina*, Faxon.

The carapace and appendages are remarkably acutely spinose, besides bearing many long coarse stiff setæ.

The carapace is strongly semi-elliptical, and is about three times the length of the narrow, depressed, acute, simple, carinated, rostrum. The strongly convex frontal margin bears four spines, a large one above the antenna on each side, and a smaller one between and behind this and the antero-lateral spine: the lateral margins are armed with 5 large spines besides the antero-lateral spine, 3 of which are in the hepatic, and 2 in the branchial region: the posterior margin is raised but smooth: on the gastric region are two transverse rows of spines, four in each row, those of the middle pair of the front row being about two-thirds the length of the rostrum.

The abdominal terga are unarmed, but deeply grooved transversely.

The eyestalks are short and immobile: their lower, their outer, and their inner border are all prolonged as spines beyond the cornea, the inner spine being more than half the length of the rostrum. The spines of the antennular and antennal peduncles are of remarkable size. The meropodite of the external maxillipeds is faintly three-toothed along the inner edge. The chelipeds are rather shorter than the ambulatory legs: they are acutely spiny up to the

hand, which has only the inner edge of the inflated palm slightly spinate: the fingers are very short, very broad and strongly spooned at tip. The 2nd to 4th legs are acutely spinate in every joint except the dactylus, which however has the usual dentations on its posterior margin. There are no epipodites on any of the thoracic legs.

Length of fully extended body 39 millim., of chelipeds 26.5 millim. Bay of Bengal, 1520 fathoms.

Regd. No.  $\frac{80}{7}$  (Type of the species).

41. *Munidopsis* (*Orophorhynchus*) *ceratophthalmus*, n. sp.  
Plate III. fig. 2.

Closely related to *M. spinoculata* A. M. Edw., from which it seems to differ only in having the chelipeds and legs armed with a few spines on the merus and carpus. Young specimens are hardly to be distinguished from *M. pilosa*, Henderson.

Rostrum about a third the length of the rest of the carapace, nearly triangular, carinated, simple.

Frontal border of carapace oblique, with a very strong supra-antennal spine: lateral border with a very strong spine behind the antero-lateral spine and an obscure denticle behind the posterior branch of the cervical groove: posterior border unarmed: dorsum with transverse ripple-like markings, which are most distinct postero-laterally, but without any spines.

Abdomen quite unarmed.

Eyes absolutely fixed: the eyestalk prolonged beyond the eye, on the inner side, as a spike more than half the length of the rostrum.

Merus of external maxillipeds with two little denticles on the ventral margin.

Chelipeds of the male much shorter than the body, faintly rugulose transversely and sparsely hairy, as are the legs: ischium with a strong spine at the inner distal angle, merus with a distal ring of 4 spines and a longitudinal dorsal row of spinules, carpus with a strong spine at the inner distal angle, hands unarmed, the fingers shorter than the palm, blunt, and strongly spooned. Legs about as long as the chelipeds, the merus spinose along the anterior border and with a terminal spine on the posterior border, the carpus with a pair of terminal spines on the anterior border, the dactylus short and stout.

There are no epipodites on any of the legs.

The abdominal appendages of the male are comparatively well developed.

In the largest male the length of the fully extended body is 42 millim., of the chelipeds 30 millim.

Andaman Sea, 480 fathoms.

Regd. Nos.  $\frac{138}{7}$  :  $\frac{140}{7}$  (Type of the species).

42. *Munidopsis (Elasmonotus) cylindrophthalmus*, Alc.

*Elasmonotus cylindrophthalmus*, Alcock, Ann. Mag. Nat. Hist., April 1894, p. 333.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XIII. FIG. 4.

The carapace is quadrangular, with the antero-lateral angles simply rounded and the surface and borders quite unarmed, the lateral borders being quite parallel. The rostrum is triangular, flat, and horizontal, with the extreme tip slightly upturned; the frontal margin, which is faintly lobed on either side of the rostrum, meets the subcristiform lateral margins at right angles; the raised posterior margin is smooth; two deep grooves, one of which crosses the cardiac region, pass across the carapace transversely.

The abdominal terga and pleura are perfectly smooth; the terga, from the second to the fourth, are transversely grooved, the edges of the groove being salient but smooth; in the case of the fourth tergum the posterior edge of the groove forms a strongly convex eminence.

The eyestalks, which are slender and extremely short, are free and freely movable; the corneæ are remarkably long and cylindrical, their length being from nearly half to about two-thirds that of the rostrum.

The basal joint of the antennary peduncles has two external terminal spines, these being the only spines found upon the animal, with the exception of the spiniform antero-external angles of the 2nd and 3rd joints of the antennal peduncles.

The antennal peduncles are long and slender, the antero-external angle of each of the second to fourth joints forming a tooth.

The external maxillipeds are long and slender, the ischium having the inner edge finely toothed, and the meropodite having two small tubercles on its lower edge near the proximal end.

The thoracic legs are perfectly smooth and hardly pubescent. The chelipeds are long—one half longer than the body and more than three times as long as the other legs in the female, more than twice as long as the fully extended body in the male—slender, and cylindrical; the fingers, which are not two-thirds the length of the palm, are singular in being rather hairy.

The second to fourth thoracic legs are slender and extremely short, being not quite as long as the carapace (with the rostrum); they all have the meropodite carinated along the anterior border and the dactylopodite (which has the usual spiny posterior border) short.



Colours in life milky red above, milk-white below.

In an adult male the length of the fully extended body is 25 millim., that of the larger cheliped 51 millim.

Andaman Sea, 188-220, 250 and 265 fathoms; Arabian Sea, 406 fathoms.

Regd. Nos.  $\frac{6906}{9}$  (Type of the species) :  $\frac{9154}{6}$  :  $\frac{3130}{9}$  :  $\frac{3189}{9}$  :  $\frac{115}{10}$ .

In the next two species, the propodites of the 3rd, and still more those of the 4th, and to a certain extent those of the 2nd, thoracic legs are dilated towards the distal end, where, on the posterior border, is a prominent group of spines, against which the proximal half of the dactylus can be folded after the fashion of a subchela.

#### 43. *Munidopsis (Bathyankyristes) tenax*, n. n.

*Bathyankyristes spinosus*, Alcock, Journ. Asiatic Soc. Bengal, Vol. LXIII, pt. 2, 1894, p. 174, pl. ix. fig. 2.  
ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE LV. FIG. 2.

Carapace broad, depressed, rather broader behind than in front, but not at all elliptical in shape: its surface pilose, and transversely rugose, especially on the branchial regions, but not spinate. The rostrum, which is more than half the length of the carapace, is stoutly styliform, upturned, and very acute. The frontal margin of the carapace is slightly excavated above the eye (somewhat as in *Aeglea*), and almost transverse; it is unarmed, but a little ventrad of it, between the eye and the antenna, is a stout spine: the lateral margins of the carapace are deeply bilobed in front of the cervical groove, each lobe ending in an acute spine, and a third smaller spine occurs immediately behind the cervical groove: the posterior border is broadly moulded, and unarmed. The abdominal terga are perfectly smooth beneath a close fine pubescence, and ungrooved.

The eyes are unpigmented: the eyestalks are not prolonged beyond the cornea. The antennules have the basal joint inflated and strongly spinate. All the joints of the antennal peduncle are strongly spinate, the spine at the antero-external angle of the true third joint being of large size. The expodite of the 1st or anterior maxillipeds is without a flagellum. The antero-external angles of the ischiopodite and meropodite of the external maxillipeds are strongly spiniform, as is also the antero-inferior angle of the ischiopodite: near the middle of the inner border of the meropodite is a single strong spine. The trunk-legs are stout and densely hairy. The chelipeds are longer than the other legs, but shorter than the fully extended body: the ischiopodite has the inner border serrulate up to a distal terminal spine, and has also a distal tooth superiorly: the meropodite is strongly and acutely spiny along its upper and inner, and the carpopodite along its inner side, both of these joints having a distal ring of spines: the hand, which is a little longer than the fingers, has a few spinules

along the inner border: the fingers are finely and evenly toothed, and excavated ventrally. The 2nd-4th legs have the meropodite and carpopodite strongly spiniferous anteriorly: in all, but especially in the fourth, the propodite is enlarged at its distal end and there has its posterior border produced to form a compressed spiniferous tubercle, against which the basal portion of the dactylus can be flexed to form a sub-chela: in the second pair of legs the tubercle carries two or three teeth, in the third pair five or six, and in the fourth pair, which are almost typical sub-chelae, six or seven: the dactyli are stout, and are minutely serrated only in that part of their posterior border which is opposed to the tubercle on the propodite. The fifth pair of trunk-legs is of the ordinary Galatheid form. There are no epipodites on any of the thoracic legs.

In the female the 2nd-5th pairs of (uniramous) abdominal appendages are present, increasing in size from before backwards.

Length of fully-extended body 70 millim., of chelipeds 59 millim.

Andaman Sea, off Ross Island, 265 fathoms.

The specific name *spinus* having been used by Milne Edwards, in 1880, for a species of the subgenus *Orophorhynchus*, is not applicable to this species.

Regd. No.  $\frac{3129}{9}$  (Type of the species).

#### 44. *Munidopsis (Bathyanstyristes) levis*, Alcock & Anderson.

*Bathyanstyristes levis*, Alcock and Anderson, Journ. Asiatic Soc. Bengal, LXIII. pt. 2, 1894, p. 175.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE LV. FIG. 3.

Closely resembles the preceding species, from which it differs only in the following particulars:—The rostrum is broader and more depressed, and is only half the length of the carapace: the eye is relatively much larger—no part of the eyestalk being visible from above: the chelipeds are much less spiny: the 2nd-4th pairs of trunk-legs have the meropodite and carpopodite quite unarmed, except for a distal spine above and below: the abdominal terga are in closer contact.

In the male the 1st and 2nd pairs of abdominal appendages resemble those of *Munidopsis*, and the 3rd-5th pairs are rudiments.

Length 29 millim.: of chelipeds 27 millim.

Arabian Sea, in the neighbourhood of the Laccadives, 636 fathoms.

Regd. No.  $\frac{9329}{9}$  (Type of the species).

#### GALACANTHA, A. M. Edw.

*Galacantha*, A. Milne Edwards, Bull. Mus. Comp. Zool. VIII. 1880, p. 52: Henderson, Challenger Anomura, p. 166: Milne Edwards and Bouvier, Ann. Sci. Nat. Zool. (7) XVI. 1894, p. 268, and Mem. Mus. Comp. Zool., XIX. No. 2, 1897, p. 55: Faxon, Mem. Mus. Comp. Zool., XVIII. 1895, p. 78.

Integument very strongly calcified.

Carapace convex, longer than broad, a little broader anteriorly than posteriorly, its surface rough; its gastric and cardiac regions well defined, each with a large antrorse median spine, largest on the gastric region; its anterolateral angles are acutely spiniform. Thoracic sternum broad.

Rostrum well developed, its proximal portion horizontal, its distal portion abruptly uptilted.

Abdomen simply flexed, the 2nd-4th terga usually with a median antrorse tooth or spine, the pleura behind the 1st well developed. Tail-fan large and symmetrical: telson as in *Munidopsis*.

Eyes without facets or pigment. Antennules and antennæ as in *Munidopsis*.

The mouth parts only differ from those of *Munida* in having a broad molar facet on the mandibles and no flagellum to the exopodite of the 1st maxillipeds.

Functional flagelliform epipodites are present on the external maxillipeds, on the chelipeds, and on the next two pairs of legs.

The chelipeds are more massive and slightly shorter than the next three pairs of legs: the last pair of legs are weak and are folded.

Abdominal appendages as in *Munidopsis*.

The gills are 14 on either side, arranged as in *Munida* and *Munidopsis*.

The eggs are few and large.

The species are all inhabitants of great depths.

#### *Key to the Indian species of Galacantha.*

- I. Carapace covered with small discrete subacute or subsquamiform tubercles, its posterior border non-spinulose:—
- |   |     |     |     |     |  |
|---|-----|-----|-----|-----|--|
| 1. 5th and 6th abdominal terga smooth                       | ... | ... | ... | ... | <i>G. rostrata</i> .                               |
| 2. 5th and 6th abdominal terga covered with small tubercles | ... | ... | ... | ... | <i>G. rostrata</i> var.<br><i>investigatoris</i> . |
- II. Carapace covered with antrorse spinules, its posterior border spinulose ... *G. spinosa*.

#### 45. *Galacantha rostrata*, A. M. Edw.

*Galacantha rostrata*, A. Milne Edwards, Bull. Mus. Comp. Zool. VIII. 1880, p. 52: S. I. Smith, Bull. Mus. Comp. Zool. X. 1882, p. 21, pl. ix. fig. 2: Milne Edwards and Bouvier, Ann. Sci. Nat. Zool. (7) XVI. 1894, p. 271, and Mem. Mus. Comp. Zool. XIX. No. 2, 1897, p. 60, pl. iv. figs. 21-24: Faxon, Mem. Mus. Comp. Zool., XVIII 1895, p. 78, pl. B. fig. 1.

*Galacantha talismani*, A. M. Edw., Henderson, Challenger Anomura, p. 167, pl. xx. fig. 1 (*vide* Milne Edwards and Bouvier, Mem. Mus. Comp. Zool. *loc.*).

*Galacantha bellis*, Henderson, Challenger Anomura, p. 167, pl. xix. fig. 6.

*Galacantha areolata*, Wood-Mason, Ann. Mag. Nat. Hist., Feb. 1891, p. 200.

*Munidopsis rostrata*, S. I. Smith, P. U. S. Nat. Mus. VII. 1885, p. 493, and Report U. S. Fish. Comm. for 1885 (1886), Albatross Crust., p. 45, pl. vi. fig. 1.

Carapace, chelipeds (except fingers) and legs (except dactyli) everywhere closely covered with small discrete tubercles which on the carapace are subacute, on the chelipeds are subsquamiform, and on the legs have a strong tendency to a linear arrangement.

Rostrum from two-fifths to less than a third the length of the carapace, its horizontal portion has an obscurely bifid ending.

The great median gastric spine is very much larger than the cardiac spine, which again is a little larger than the paired gastric spines. Of the two oblique spines of the lateral borders the hepatic is much larger than the antero-lateral. Posterior border quite smooth.

The 2nd–4th abdominal terga are deeply grooved transversely and are only obscurely granular, each is armed with a median procurved spine, of which the third is smaller and blunter than the first two. The pleura of the 2nd abdominal somite are tubercular, like the carapace: those of the 3rd and 4th are only obscurely so. The last two terga and the telson are smooth and polished, except for a few scattered vesiculous granules on and near the telson.

Eyes large, freely movable, somewhat reniform on the inner side. The basal joint of the antennular peduncle ends externally in two spines, one of which is large. The antennal peduncle is non-spinose, and the flagellum is much longer than the body.

The ventral border of the merus of the external maxillipeds is subcristiform and cut into 2 or 3 spines, 2 of which are very large.

The chelipeds are much shorter than the extended body: the borders of the merus and carpus end in teeth or spines none of which are conspicuous except one on the carpus: the fingers are longer than the palm, straight, incurved at tip, and deeply excavated on the inner surface.

The legs are a little longer than the chelipeds: they are non-spinose except for the terminal teeth or spines of the merus, and their dactyli have the posterior edge serrated.

The colours in life, as observed in these seas, varies from dull chalky-orange to bright orange red with whitish patches.

Bay of Bengal, 1300, 1310 and 1520 fathoms; Arabian Sea, 1022 and 1070 fathoms.

In the largest specimen—an egg-laden female—the total length of the fully extended body is 51 millim., that of the chelipeds 32 millim.

Regd. Nos.  $\frac{7667}{6}$  :  $\frac{8874}{6}$  :  $\frac{79}{7}$  :  $\frac{6108}{9}$  :  $\frac{9326}{9}$  :  $\frac{3413-3416}{10}$ .

***Galacantha rostrata*** var. *Investigatoris*, Alc. & Anderson.

*Galacantha investigatoris*, Alcock and Anderson, Journ. Asiatic Soc. Bengal, LXIII. pt. 2, 1894, p. 173.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XII. FIG. 4.

Differs only in the following unimportant particulars:—

*All* the abdominal terga behind the 1st (including the telson) and pleura are



closely covered with subacute or subsquamiform tubercles similar to those of the carapace.

The horizontal portion of the rostrum is deeply bifid at tip, and the two spines of the antero-lateral margins of the carapace are much longer.

The length of the fully-extended body, in the female, is 56 millim., that of the chelipeds 36 millim.

Colour in life, chalky orange.

Arabian Sea, off the island of Minnikoy, 1200 fathoms.

Regd. No.  $\frac{8816}{9}$ .

46. *Galacantha spinosa*, A. M. Edw. var. *trachynotus*, Anderson.

*Galacantha trachynotus*, Anderson, Journ. Asiatic Soc. Bengal, Vol. LXV. pt. 2, 1896, p. 100.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XXV. FIG. 3.

Differs from *G. rostrata* only in the following particulars:—

Instead of tubercles the carapace and chelipeds are covered, but not so closely, with spines and spinules, which, on the carapace, have a very definite arrangement.

The horizontal portion of the rostrum is more decidedly bifid.

Besides the large gastric and cardiac spines, and the large antero-lateral and hepatic spines, and the numerous spinelets, there is on the lateral border, immediately behind the cervical groove, a spine of considerable size. The posterior border of the carapace is armed with a row of small spines.

The 2nd–4th abdominal terga are deeply grooved transversely and the raised edges of the grooves are strongly serrated, the middle tooth of the anterior ridge of each tergum being enlarged: a row of teeth is continued on to the corresponding terga. There are some scattered tubercles on the 5th and 6th terga, and on the telson, and the anterior border of the 5th tergum is serrated.

The angles of the 2nd, 3rd and 4th joints of the antennal peduncle are spiniform.

The terminal spines of the borders of the merus and carpus of the legs and chelipeds are conspicuous.

Colour in life milky orange.

In the largest specimen the length of the fully extended body is 30 millim., that of the chelipeds 21 millim.

Arabian Sea, 912, 912–931 and 947 fathoms.

The only difference between the Indian specimens and the one figured by Milne Edwards and Bouvier (in Mem. Mus. Comp. Zool. XIX. No. 2, 1897, pl. iv. figs. 14–20) is that in the Indian specimens the spines of the antero-lateral

borders are smaller, the horizontal portion of the rostrum is very distinctly bifid, and the spinelets of the dorsal surface of the chelipeds and legs are larger, while the epipodite of the 4th (penultimate) thoracic legs is, as in *G. rostrata*, a mere tubercle without a lash.

Regd. Nos.  $\frac{113}{10} : \frac{114}{10} : \frac{118}{10}$ .

### Family *Uroptychidæ*.

*Diptycinés*, A. Milne Edwards and Bouvier, Ann. Sci. Nat., Zool. (7) XVI. 1894, pp. 296, 312-313.

*Galatheidæ* (part), Henderson, Challenger Anomura, and Stebbing, Hist. Crust.

*Chirostylidæ*, Ortmann in Bronn's Thier Reich Malacostraca, p. 1149.

Carapace longer than broad, either depressed with the lateral borders well defined, or convex and subcylindrical, its surface either spinose or perfectly smooth.\* Thoracic sternum broad, the last segment more or less atrophied. Rostrum well developed.

In addition to the abdomen being folded on itself, the tail-fan is tucked in beneath the preceding abdominal somites, the telson being transversely divided. The 1st somite is only partly hidden by the carapace, and the infolded angles of the carapace are held down (as in many *Macrura*) between the outer angles of this somite and the very prominent antero-external angles of the 2nd somite. The pleura behind the 1st somite are very well developed.

Eyestalks short, no orbits. Antennular peduncles weak, the basal joint not widely dilated: the flagella, especially the lower one short.

Antennal peduncle 5-jointed, the 3rd joint being quite distinct: the flagellum of no great length. A movable acicle is often present at the outer angle of the 2nd joint of the peduncle.

The incisor edge of the mandible is serrated. No epipodite is present on the external maxillipeds.

Chelipeds and next 3 pairs of legs well developed, sometimes very long and slender: the last pair of legs weak and flexed.

In the males, and often also in the females, a reduced number of the abdominal somites are furnished with appendages.

#### *Key to the genera of Uroptychidæ of the Indian Oligobenthos.*

- I. Carapace convex, the lateral borders inflated and not sharply defined: rostrum spiniform: antennal acicle wanting: chelipeds and first 3 pairs of legs slender and of enormous length ... .. PTYCHOGASTER.
- II. Carapace with the lateral borders very sharply defined: rostrum acutely triangular: antennal acicle long and conspicuous: chelipeds long, next 3 pairs of legs of moderate length ... .. UROPTYCHUS.

\* In no Indian *Uroptychidæ* is the carapace transversely rugulose.

## PTYCHOGASTER, A. M. Edw.

*Ptychogaster*, A. Milne Edwards, Bull. Mus. Comp. Zool. VIII. 1880, p. 63: Henderson, Challenger Anomura, p. 170: Milne Edwards and Bouvier, Ann. Sci. Nat. Zool. (7) XVI. 1894, p. 301, and Mem. Mus. Comp. Zool. XIX. No. 2, 1897, p. 117: Bouvier, Bull. Soc. Entomol. France, LXV. 1896, pp. 307-312.

*Chirostylus*, Ortmann, Zool. Jahrb., Syst. VI. 1891-92, p. 244.

*Gastroptychus*, Caullery, Caudan Crust. Ann. Univ. Lyon., 1896, p. 390.

Carapace convex, subcylindrical, broader behind than in front, usually spinose, the gastric region well defined: it is held down by the incurved posterolateral angles. Thoracic sternum broad its last segment very much reduced. Rostrum slender and spiniform.

Abdomen folded on itself, the pleura behind the 1st well developed: tail-fan symmetrical; telson transversely fissured and folded under the preceding somites with the caudal swimmerets.

Eyes well pigmented. Antennular peduncles weak and flexed, the last joint elongate; the lower flagellum very much shorter and slenderer than the upper. Antennal peduncles slender, five-jointed without a movable acicle: the flagellum of no great length.

Mandibles with an incurved palp and with the edge of the incisor process serrated.

The exopodites of all the maxillipeds are flagellated, and the external maxillipeds are pediform. None of the maxillipeds and none of the thoracic legs have epipodites.

The chelipeds and next 3 pairs of legs are slender, spiny and of enormous length; the last pair of legs are weak and infolded.

In the male the 1st and 2nd abdominal somites carry paired appendages modified for copulation, and rudimentary paired appendages are present on the next three somites: in the female slender paired appendages are present on the 2nd-5th somites.

The eggs are large and not numerous.

In both the Indian species the branchial formula is as follows:—

Somites and their appendages.	Podobranchiæ.	Arthrobranchiæ.		Pleurobranchiæ.	
		Anterior.	Posterior.		
VII	0	0	0	0	= 0
VIII	0	0	0	0	= 0
IX	0	1	1	0	= 2
X	0	1	1	0	= 2
XI	0	1	1	1	= 3
XII	0	1	1	1	= 3
XIII	0	1	1	1	= 3
XIV	0	1	0	0	= 1
<b>Total.</b>	0	6	5	3	= 14 (no epipodites).

The arthrobranchiæ of somite IX are small and slender and are crushed up against the bases of the 2nd maxillipeds to which, at first sight, they appear to belong.

*Key to the Indian species of Ptychogaster.*

- I. The first segment of the telson is not much more than half the antero-posterior diameter of the second segment ... .. *P. hendersoni*.
- II. The antero-posterior diameter of the first segment of the telson is much more than half that of the second ... .. *P. investigatoris*.

47. *Ptychogaster Hendersoni*, Alcock & Anderson.

*Ptychogaster hendersoni*, Alcock and Anderson, Ann. Mag. Nat. Hist., Jan., 1899, p. 23.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLV. FIG. 2.

Carapace (including rostrum) equal in length to the first six fully extended abdominal terga, covered with spinules and spines, in which a definite serial arrangement of the larger spines is hardly manifest.

All the abdominal terga (telson excepted) and pleura bear spines: the first tergum has a transverse spiny carina continuous with a similar carina on the anterior edge of the second pleura; the second has two such carinæ; the third has a longitudinal row of spines at the junction with either pleura but is otherwise smooth; the fourth and fifth have two transverse series of spines, besides an occasional spine on their posterior edge; the sixth has numerous spines, including three conspicuous transverse series.

First segment of the telson not much more than half the length of, and slightly broader than, the second.

External maxillipeds unarmed, except for the fine teeth along the inner edge of the ischium, hairy along inner edge, especially at distal end.

Chelipeds and legs long, slender, and spiny; in the female (male unknown) the chelipeds are more than  $2\frac{3}{4}$  times the length of the fully extended body and nearly half as long again as the legs; the first two pair of legs are nearly of one length, but the third pair are the longest by nearly a dactylus, owing to the elongation of their propodite, which is nearly five times as long as the dactylus.

A female from off the Travancore coast, 430 fathoms, is 30 millim. in extreme length when fully extended, and has chelipeds 86 millim. long and the third pair of legs 55 millim. long.

Colour salmon-pink, eyes deeply pigmented.

Regd. No.  $\frac{2348}{10}$  (Type of the species).



48. *Ptychogaster investigatoris*, Alcock & Anderson.

*Ptychogaster investigatoris*, Alcock and Anderson, Ann. Mag. Nat. Hist., Jan. 1899, p. 24.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLV. FIG. 1.

Carapace short, its length (including the rostrum, which is between a half and a third that of the rest of the carapace) is only equal to that of the first five and a half fully extended abdominal terga; its surface is everywhere studded with spinules and spines, the largest of which show a tolerably plain arrangement in four longitudinal series.

The only abdominal tergum (besides the telson) that is perfectly free from spines is the third: the first tergum has a transverse spiny carina continuous with a similar carina on the edge of either pleura of the second segment; the second has a transverse raised row of four large spines, besides several teeth; both the fourth and fifth are separated from their pleura on either side by a longitudinal row of two or three spines or serrations but are otherwise smooth; the sixth is covered with retrorse spinules and spines, including three conspicuous transverse series, of which the last far overhang the telson.

The first segment of the telson is hardly perceptibly shorter, and slightly narrower, than the second; the surface of both bears some inconspicuous capillary spinelets or bristles.

The pleura of the third and fourth abdominal somites are devoid of spines.

The external maxillipeds are unarmed, except for the ischial serrations, and are very hairy in their distal half.

Chelipeds and legs long, slender, and spiny; the chelipeds in the female (male unknown) are about  $2\frac{2}{5}$  times the length of the fully extended body and half as long again as the legs; the racket-like form of the hand, due to the bowing of the basal half of the fingers, is more than ordinary conspicuous.

Of the first three pair of legs the first is slightly the longest and the second slightly the shortest; the dactyli of all are hardly more than a quarter the length of the propodites.

A female from the Andaman Sea, 405 fathoms, is 55 millim. in length when fully extended, and has chelipeds 132 millim. and first legs 91 millim. long.

The eyes are large and rather pale.

Regd. No.  $\frac{1378}{10}$  (Type of the species).

## UROPTYCHUS, Henderson.

*Diptychus*, A. Milne Edwards, Bull. Mus. Comp. Zool., VIII. 1880, p. 61, and Milne Edwards and Bouvier, Ann. Sci. Nat. Zool., (7) XVI. 1894, p. 303, and Mem. Mus. Comp. Zool. XIX, No. 2, 1897, p. 123 (*nom. preocc.*).

*Uroptychus*, Henderson, Challenger Anomura, p. 173.

Carapace somewhat depressed with the lateral borders well defined, broader

behind than in front, held down by the incurved postero-lateral angles. Thoracic sternum broad, its last segment atrophied.

Rostrum acutely triangular.

Abdomen folded on itself, the telson, which is transversely fissured and very small, is, with the symmetrical caudal swimmerets, folded under the preceding somites. The pleura behind the first are fairly well developed.

Eyes well pigmented, the eyestalks short and stout and not dilated. Antennular peduncles weak and flexed; the lower flagellum very much shorter and slenderer than the upper.

Antennal peduncles five-jointed, the second joint with a movable acicle: the flagellum of no great length.

The mandibles, which carry an incurved 3-jointed palp, have the molar process hardly apparent and the edge of the incisor process serrated.

The exopodites of all the maxillipeds are flagellated.

There are no epipodites on any of the maxillipeds or thoracic legs.

The external maxillipeds are pediform with the propodite elongate.

Chelipeds very much longer and considerably stouter than the legs: the last pair of legs weak and infolded.

In the male the first 2 abdominal somites carry paired appendages modified for copulation, and rudimentary paired appendages are present on the 3rd and 4th somites. In the female paired appendages are present on the 3rd and 4th somites.

The eggs are large and not numerous.

The branchial formula is as follows:—

Somites and their appendages.	Podobranchiæ and epipodites.	Arthrobranchiæ.		Pleurobranchiæ.	
		Anterior.	Posterior.		
VII	0	0	0	0	= 0
VIII	0	0	0	0	= 0
IX	0	1	1	0	= 2
X	0	1	1	0	= 2
XI	0	1	1	1	= 3
XII	0	1	1	1	= 3
XIII	0	1	1	1	= 3
XIV	0	1	0	0	= 1
Total	0	6	5	3	= 14 (no epipodites).

*Key to the species of Uroptychus of the Indian Benthos and Oligobenthos.*

- I. Carapace and chelipeds spinose ... .. *U. fusimanus.*  
 II. A pair of spines on the gastric region: chelipeds non-spinose ... *U. nigricapillis.*

III. No spines on dorsum of carapace: chelipeds non-spinose:—

1. Major diameter of eye about a third the length of the rostrum:  
propodites of 2nd, 3rd and 4th legs with numerous spinelets on  
the posterior border ... .. *U. australis*.
2. Major diameter of eye about a fifth the length of the rostrum:  
propodites of 2nd, 3rd and 4th legs with a single (terminal)  
spinelet on the posterior border ... .. *U. bacillimanus*

#### 49. *Uroptychus fusimanus*, Alcock & Anderson.

*Uroptychus fusimanus*, Alcock and Anderson, Ann. Mag. Nat. Hist., Jan. 1899, p. 26.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLIV. FIG. 4.

Dorsal surface of carapace studded with numerous spines in more or less distinct rows, the well-defined cristiform lateral borders acutely spinate. Abdomen perfectly smooth.

Carapace (without rostrum) slightly longer than broad; cervical suture very well defined; rostrum acutely triangular, simple, the frontal margin on either side of it deeply concave for the eye, forming a distinct orbital notch. Eye of good size and well pigmented.

Antennal acicle large, reaching as far as the tip of the peduncle.

Chelipeds in both sexes equal, about  $1\frac{2}{3}$  times the length of the fully extended body, much stouter and rather more than one-third of their extent longer than the legs, subcylindrical as far as the compressed and broadened hands; along the upper and inner surfaces of the arm and wrist are longitudinal rows of spines, those in at least two rows being conspicuously enlarged and sharply raised; hands smooth, broadened, the edges of the palm almost cristiform.

First three pair of legs slender, smooth, the meropodites somewhat dilated, the third pair about a dactylus shorter than the other two; the dactyli are less than a third the length of their propodites, and they have the posterior border finely toothed in the distal two-thirds: an acicular spine is found at the end of the posterior border of the propodite.

Seven specimens (one an egg-laden female), from off the Travancore coast, 430 fathoms.

The fully extended body of the largest female measures 31 millim. and the chelipeds 53 millim.; that of the largest male measures 27 millim. and the chelipeds 42 millim.

Regd. Nos.  $\frac{2339-2345}{10}$  (Types of the species).

#### 50. *Uroptychus nigricapillis*, n. sp. Plate III. fig. 3.

Carapace smooth except for a pair of largish spines on the gastric region on either side and behind the base of the rostrum. The antero-lateral angles

and the anterior pterygostomian angles of the carapace are spiniform, and the lateral borders behind the cervical groove are serrated, the first tooth, which is hepatic in position, being of fair size. Abdomen perfectly smooth.

Rostrum acutely triangular, with trenchant edges, not more than a third of its length lies beyond the eyes.

Eyes of good size, their major diameter about a third the length of the rostrum.

The antennal acicle reaches about two-thirds of the way along the antennal peduncle.

External maxillipeds unarmed.

Chelipeds in the female more than three times the length of the carapace (rostrum included), smooth, glabrous except a tuft of silky black setæ concealing the tips of the fingers.

In the next 3 pairs of legs there are some silky setæ on the dactyli, the posterior border of the dactyli is serrated, and there are a series of acicular spinelets along the middle of the posterior border of the propodites.

The outer ends of the individual thoracic sterna are well defined and serrulate.

Andaman Sea, 669 fathoms.

Regd. No.  $\frac{3443}{10}$  (Type of the species).

51. *Uroptychus australis*, Henderson, var. *indicus*, nov.

Appears to differ from the form described by Henderson (Challenger Anomura, p. 179, pl. xxi. fig. 4) only in the sculpture of the chelipeds, which are smooth except for some vesiculous granules on the ventral surface of the ischium merus and carpus of the chelipeds: the antero-lateral angles of the carapace and the anterior pterygostomian angle also seem to be more decidedly spiniform.

Carapace smooth unarmed, except for the spiniform antero-lateral and pterygostomian angles, its lateral borders to the naked eye are smooth and unbroken, but under the lens are in places very finely crenulate. Rostrum triangular, acute, with trenchant edges, not quite a third of its length lies beyond the eyes.

Abdomen smooth and polished.

Eyes of good size, their major diameter more than a third the length of the rostrum.

The antennal acicle nearly reaches to the end of the antennal peduncle.

External maxillipeds unarmed.

The chelipeds are from  $3\frac{1}{2}$  to nearly 4 times the length of the carapace (rostrum included) and are stouter in the male than in the female: they are glabrous except for a few silky setæ in the distal half of the fingers, and they



are perfectly smooth except for some vesiculous granules on the ventral surface of the ischium merus and carpus: in the male the palm is a little broadened and inflated, and in both sexes there is an enlarged bicuspid tooth at the basal end of the cutting edge of the dactylus.

The legs are about half the length of the chelipeds: they have a few scattered silky setæ of enormous length; their propodites are slightly expanded in their distal half, where the posterior border is serrated; their dactyli are strongly serrated along the posterior border.

The thoracic sternum has its edges deeply lobed in correspondence with the segments of which it consists: the segment corresponding with the external maxillipeds has a pair of median teeth, and that of the chelipeds has its anterior angles strongly spiniform.

Length of fully extended body of an adult male 30 millim., of chelipeds 70 millim.

Arabian Sea, off Cape Comorin, 459 fathoms: Bay of Bengal, off Ceylon, 805 fathoms.

Regd. Nos.  $\frac{9328}{9}$ :  $\frac{1356}{10}$ :  $\frac{1362}{10}$ :  $\frac{3759}{10}$ :  $\frac{3760}{10}$ .

## 52. *Uroptychus bacillimanus*, Alcock & Anderson.

*Uroptychus bacillimanus*, Alcock and Anderson, Ann. Mag. Nat. Hist., Jan. 1899, p. 25.

ILLUSTRATIONS OF THE ZOOLOGY OF THE INVESTIGATOR, CRUSTACEA, PLATE XLV. FIG. 3.

Nearest to *U. gracilimanus*, Henderson, from which it seems to differ only in having the carapace pitted and the posterior border of the propodites of the legs unarmed, and to the Atlantic *U. rubrovittatus*, A. M.-Edw., from which it differs in having slender chelipeds and also the posterior border of the propodites of the legs unarmed.

Carapace unarmed, except for a tiny spinule at either antero-lateral angle and another even smaller at the outer angle of either orbital notch; its surface covered with a fine squamiform pitting, its lateral borders with a regular squamiform crenulation.

Rostrum triangular, simple, acute, more than a third of its length projecting beyond the eyes.

Abdomen smooth; the third to sixth pleura rounded.

Eyes small, their major diameter less than a fifth the length of the rostrum, brown in colour.

Antennal acicle acutely triangular, reaching about two-thirds the distance along the terminal joint of the antennal peduncle.

Chelipeds in both sexes about twice the length of the fully extended body, very slender in the male, still more slender in the female, perfectly smooth, but

bearing (as do also the legs) some curiously long and delicate silky hairs; the hand is longer and slightly broader than the wrist, the fingers are considerably less than half the length of the palm.

Legs slender, less than half the length of the chelipeds; a few spinules on the posterior border of the dactyli, but only a single one (situated terminally) on the posterior border of the propodites.

A young male and female from off the Travancore coast, 430 fathoms, and an egg-laden female from off Ceylon, 820-296 fathoms.

Length of fully extended body of female 29 millim., of chelipeds 54 millim.

Regd. Nos.  $\frac{2349-2350}{10}$  (Types of the species):  $\frac{768}{10}$ .

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EXPLANATION OF PLATES.

PLATE I.

Figs. 1, 1a. *Willemoesia indica*, natural size.

Figs. 2, 2a. *Nephropsis ensirostris*,  $\times 1\frac{1}{2}$ .

PLATE II.

Fig. 1. *Iconaxiopsis andamanensis*,  $\times 2$ .

Fig. 1a. Part of the antenna of *Iconaxiopsis andamanensis*,  $\times 4$ .

Fig. 2. *Spongicola andamanica*,  $\times 6$ .

Fig. 3. *Engystenopus palmipes*,  $\times 2$ .

Fig. 4. *Gebicula exigua*,  $\times 6$ .

PLATE III.

Fig. 1. *Munidopsis (Orophorhynchus) granosa*,  $\times 2$ .

Fig. 2. *Munidopsis (Orophorhynchus) ceratophthalmus*,  $\times 1\frac{1}{2}$ .

Fig. 3. Carapace etc. of *Uroptychus nigricapillis*,  $\times 6$ .

Fig. 3a. Hand of *Uroptychus nigricapillis*,  $\times 3$ .

Fig. 4. *Munidopsis (Orophorhynchus) Edwardsi*,  $\times 1\frac{1}{2}$ .

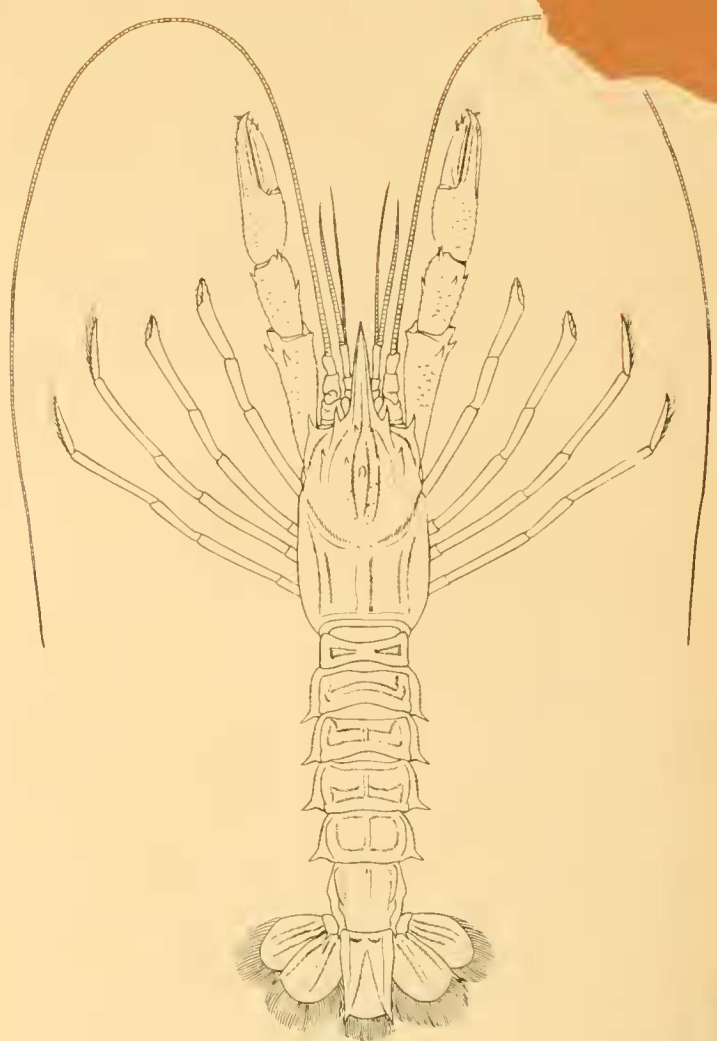
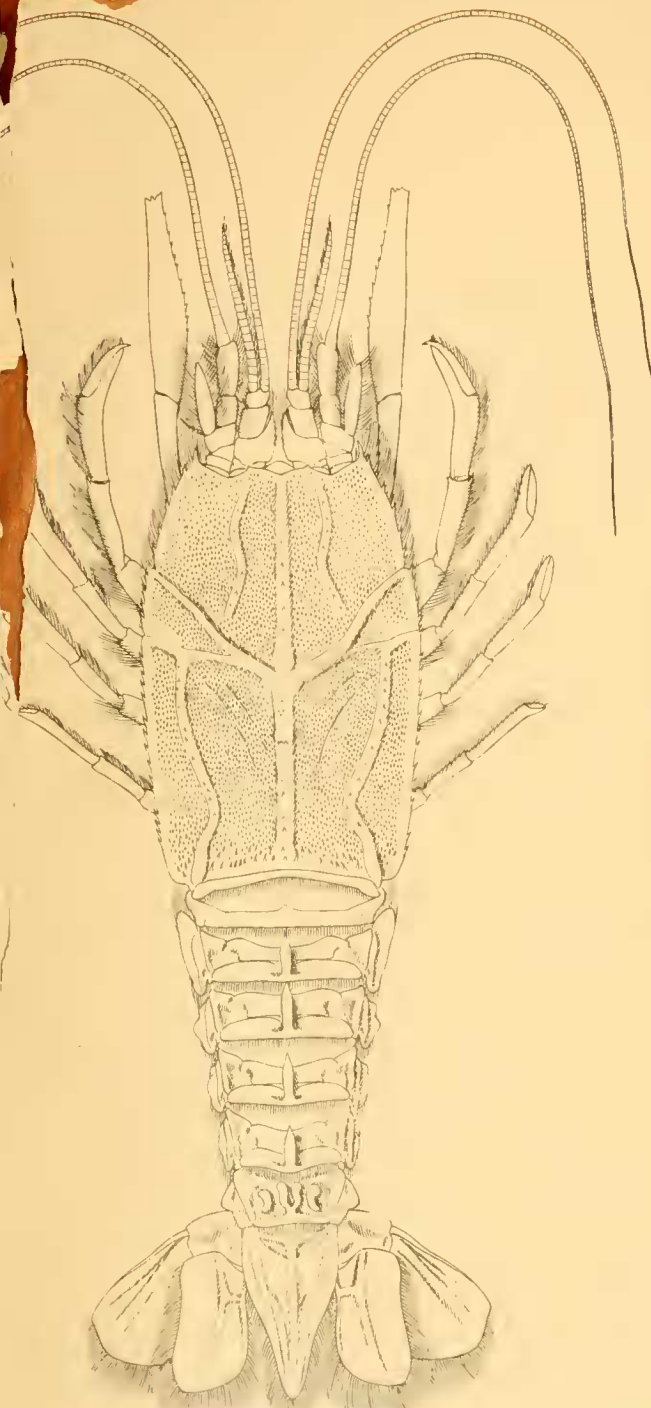
Alcock, A. 1901 loose plates from book

A descriptive catalogue of the Indian Deep-Sea Crustacea  
Decapoda Macrura + Anomala in the Indian Museum  
Investigator

Keep these plates with bound volume

LIBRARY  
Division of Crustacea

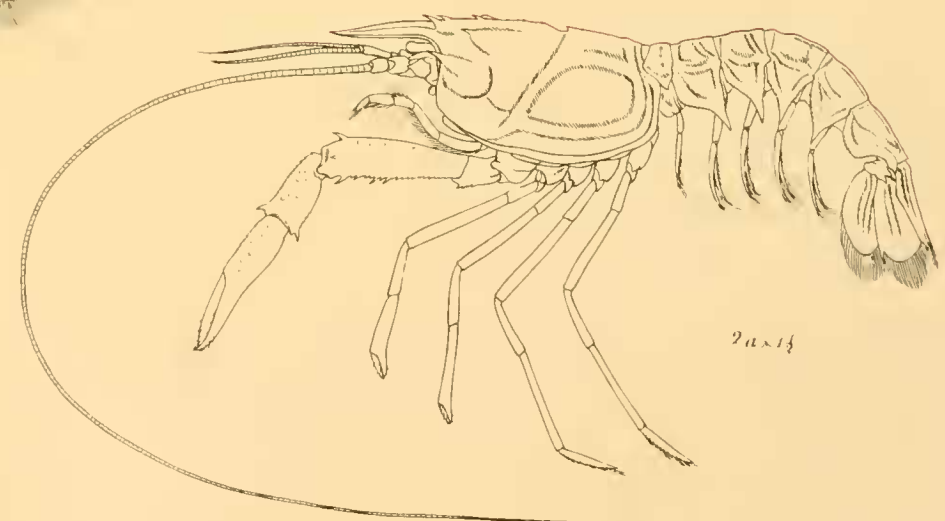




3 14



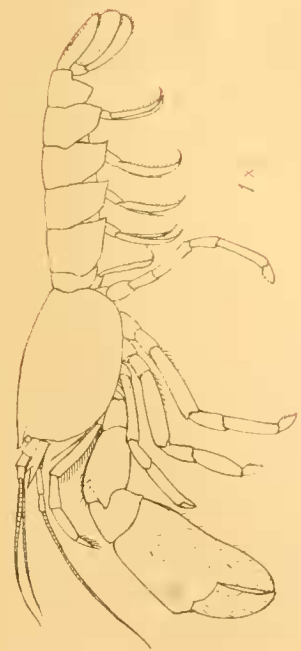
1a



2a x 14

1. *Acipura* *nitida* ♂

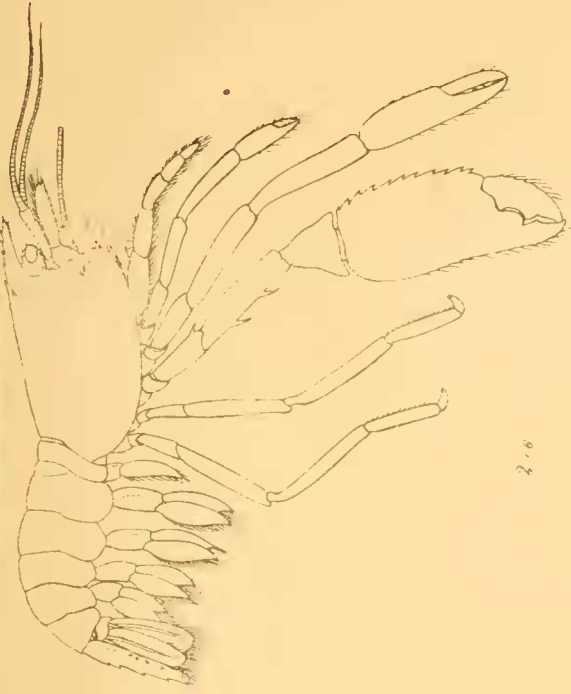
2. *Nephropsis* *macrostris* ♀



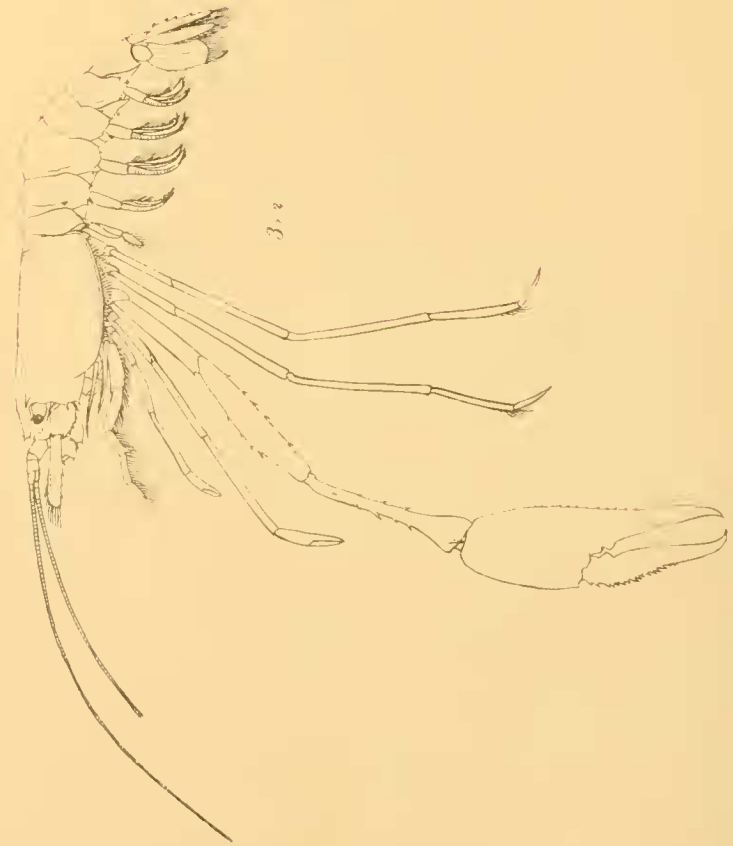
1A



1B



2



3



4

1. *Macrobrachium* A. C. Chowdhury Bith.

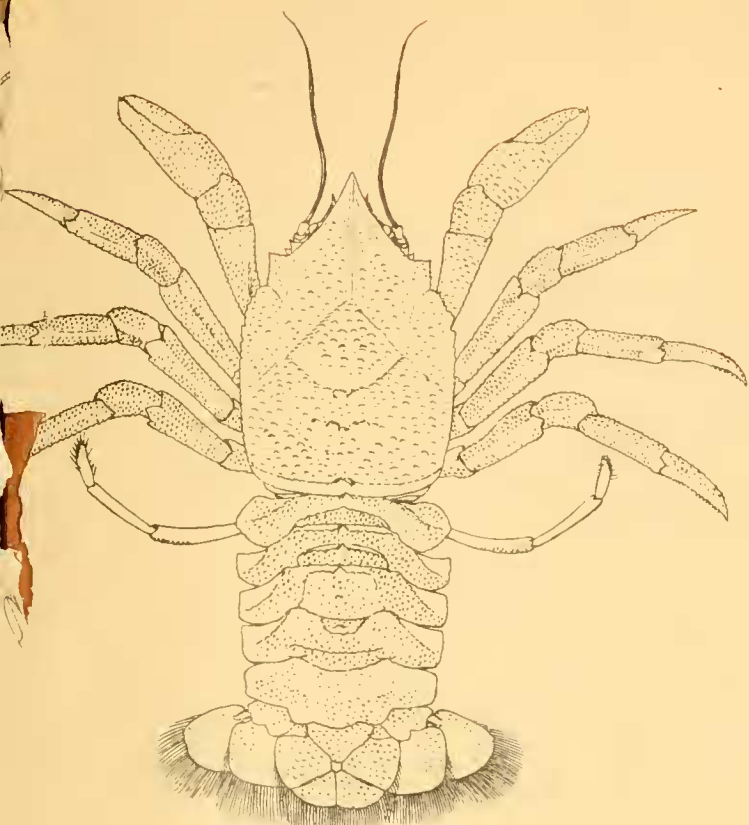
11a. *Leontoxiphus* Boudier and Pavesi

12. *Pongipoda* Boudier and Pavesi

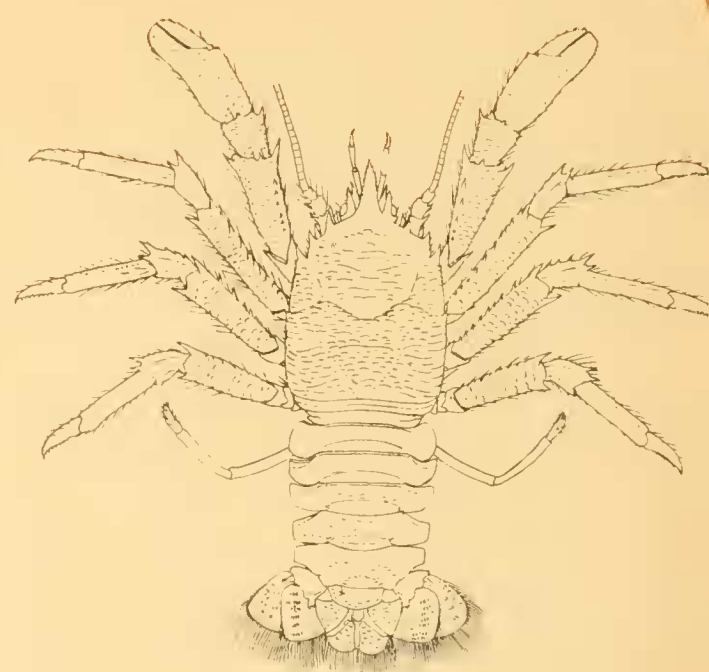
A. C. Chowdhury Bith.

3. *Eugyasteropsis* Boudier and Pavesi

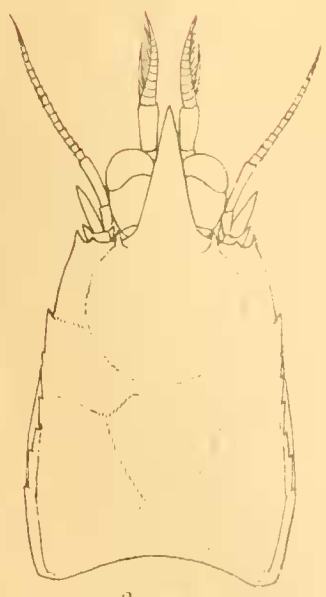
4. *Gobriella* Boudier and Pavesi



1. 2



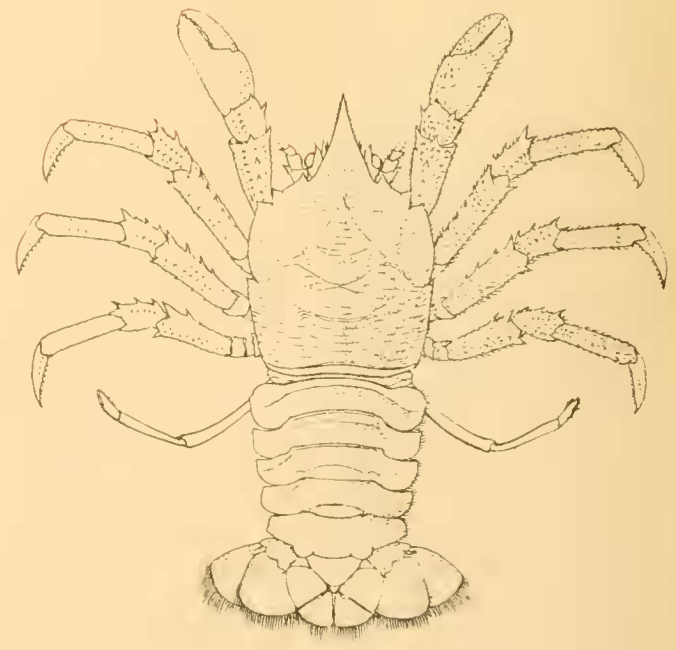
2 x 1/2



3 x 1/2



3a x 4



4 x 1/2

- 1 *Munidopsis granosa*
- 3 *Uroptychus nigricapillus*

- 2 *Munidopsis ceratophthalmus*.
- 4 *Munidopsis edwardsii*

A. C. Chowdhary, & S. C. Mandal, del. et. Lith.